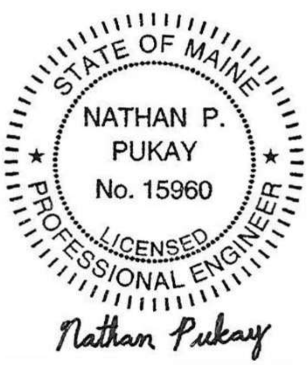
MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL DESIGN REPORT

For the Replacement of:

LITTLE TOMAH BRIDGE
STATE ROUTE 6 OVER LITTLE TOMAH STREAM
CODYVILLE TOWNSHIP, MAINE



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Washington County | Soils Report 2024-18
WIN 25387.00 | Bridge No. 2472

Federal Project No. 2538700
November 20, 2024

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1.0 INTRODUCTION

The purpose of this Geotechnical Design Report is to present subsurface information and provide geotechnical design recommendations for the replacement of Little Tomah Bridge which carries State Route 6 over Little Tomah Stream in Codyville Township, Maine. This report presents the subsurface information obtained at the site during the subsurface investigation, geotechnical design recommendations, and construction recommendations for the new substructures.

The existing Little Tomah Bridge was constructed in 1982. The structure consists of a single 19-foot 11-inch span by 12-foot 10-inch rise structural plate pipe arch bearing on 1-foot of granular borrow. The bridge was temporarily closed after a storm on December 11, 2023, caused high water conditions that washed away the roadway gravel above the culvert. The bridge was backfilled, inspected, and reopened a few days later. According to the December 2023 Maine Department of Transportation (MaineDOT) Bridge Inspection Report, the FHWA Sufficiency Rating of the bridge was reduced to a 25.0. The bridge was already scheduled for replacement due to the poor condition of the culvert, but MaineDOT has accelerated the advertise date.

Available as-built drawings indicate previous structures at the bridge include a crib bridge and a concrete deck slab bridge founded on mass concrete abutments.

The proposed replacement structure consists of a 88-foot, single-span bridge founded on rock-socketed, pile-supported integral abutments with in-line wingwalls. MaineDOT has identified steel girders, Press-Brake Formed Tub Girders (PBTG), and precast, prestressed concrete bulb-tee or AASHTO I-beams as suitable superstructure replacement options. The project will be advertised as a “Detail-Build” project to allow the awarded contractor to select the superstructure that is most favorable for project speed and cost efficiency. The awarded contractor will design both the rock-socketed H-pile substructure and the chosen superstructure while adhering to the requirements in the contract documents.

The new Little Tomah Bridge will be located on a horizontal and vertical alignment that will approximately match the existing.

Traffic will be maintained on a temporary detour built on the upstream side of the existing bridge.

2.0 GEOLOGIC SETTING

Little Tomah Bridge carries State Route 6 over Little Tomah Stream as shown on Sheet 1 – Location Map.

The Maine Geological Survey (MGS) Surficial Geology Map of the Fredericton Quadrangle, Maine, Open-File No. 87-13 (1987), indicates the surficial soils in the vicinity of the bridge project consist of marsh deposits and glacial till. Marsh deposits consist of peat, muck, silt, and sand. Glacial till is a heterogeneous mixture of sand, silt, clay, and stones deposited by glacial ice.

The MGS Bedrock Geology of the Calais Quadrangle, Maine, Open-File No. 03-97 (2003), maps the bedrock at the site as variably calcareous, Graywacke interbedded with Slate.

3.0 Subsurface Investigation

Five test borings and three bridge probes were drilled to explore subsurface conditions at the site. Borings BB-CLTS-101, -201, -202 were drilled at the location of proposed Abutment No. 1. Borings BB-CLTS-102 and -203, and bridge probe BP-CLTS-204 were drilled at the location of proposed Abutment No. 2. Bridge probes BP-CLTS-103 and BP-CLTS-104 were drilled to confirm the remains of a concrete abutment from a preexisting bridge structure. The borings and bridge probe locations are shown on Sheet 2 – Boring Location Plan.

The 100-series borings and probes were drilled in October 2022 by the MaineDOT Drill Crew. The remaining borings and probes were drilled in January 2024 by S.W. Cole Explorations. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented in the boring logs provided in Appendix A – Boring Logs and on Sheets 4 and 5 – Boring Logs.

Bridge probes were performed by advancing a solid stem auger to refusal. Borings were performed by using a combination of solid stem auger, cased wash boring and rock coring techniques. Soil samples were typically obtained at 5-foot intervals using Standard Penetration Test (SPT) methods. During SPT sampling, the sampler is driven 24 inches and the hammer blows for each 6-inch interval of penetration are recorded. The sum of the blows for the second and third intervals is the N-value, or standard penetration resistance. The drill rigs used in the subsurface investigation were equipped with automatic hammers to drive the split spoon. The hammers were calibrated per ASTM D 4633 "Standard Test Method for Energy Measurement for Dynamic Penetrometers" to establish hammer efficiency factors. All N-values discussed in this report are corrected N-values computed by applying the hammer efficiency factors. The hammer efficiency factors and both the raw field N-value and corrected N-value (N_{60}) are shown on the boring logs.

Bedrock was cored in the borings using NQ-2" core barrels and the Rock Quality Designation (RQD) of the cores calculated. The MaineDOT geotechnical engineer selected the boring locations and drilling methods, designated type and depth of sampling techniques, identified field-testing requirements, and logged the subsurface conditions encountered in the borings. The borings were located in the field using taped measurements at the completion of the drilling program and then located by MaineDOT Survey.

4.0 Laboratory Testing

A laboratory testing program was conducted on selected soil and bedrock core samples recovered from the test borings to assist in soil classification, evaluation of engineering properties of the soil and bedrock, and geologic assessment of the project site. Laboratory testing on soil samples consisted of four standard grain size analyses with natural water content, two grain size analyses with hydrometer and natural water content, one Atterberg limit test, one pH test, and one electrical resistivity test. Two bedrock core samples were tested for compressive strength and elastic moduli.

Soil laboratory testing was performed at the MaineDOT Lab in Bangor, Maine with exception of the pH test and electrical resistivity test, which was performed by GeoTesting Express (GTX) of Acton, Massachusetts. GTX performed all testing on the rock core samples. The results of soil and rock tests are included in Appendix C – Laboratory Test Results. Moisture content information and other soil test results are also presented on the boring logs provided in Appendix A – Boring Logs and on Sheets 4 and 5 – Boring Logs.

5.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered in the test borings generally consisted of Fill, Marsh Deposits, Glacial Till, and Bedrock. The boring logs are provided in Appendix A – Boring Logs and on Sheets 4 and 5 – Boring Logs. A generalized subsurface profile is shown on Sheet 3 – Interpretive Subsurface Profile. The following paragraphs discuss the subsurface conditions encountered.

5.1 Fill

A layer of Fill was encountered in the test borings. The thickness of the Fill unit encountered was approximately 11 to 17 feet. The fill materials encountered consisted of:

- Brown, SAND, some gravel, little to some silt, trace clay;
- Brown to dark brown, Gravelly SAND, trace to little silt, trace organics;
- Grey-brown, GRAVEL, trace silt; and
- Cobbles.

Corrected SPT N-values in the Fill ranged from 13 to greater than 50 blows per foot (bpf) indicating the material is medium dense to very dense in consistency.

Three grain size analyses performed on samples recovered from the Fill unit indicated the material is classified as A-1-a, A-1-b and A-2-4 under the AASHTO Soil Classification System and SW-SM, SM and SC-SM under the Unified Soil Classification System (USCS). The natural water contents of the samples tested ranged from 5 to 14 percent.

5.2 Marsh Deposits

Marsh Deposits were encountered in BB-CLTS-102, -202, and -203 beneath the fill unit. The encountered thickness was approximately 4 to 8 feet. The deposits were variable and consisted of:

- Grey, SILT, some sand, trace clay, trace gravel;
- Brown, Silty SAND, little gravel; and
- PEAT.

One corrected SPT N-value within the Marsh Deposits was less than 2 bpf, and another SPT N-value was 7 bpf, indicating the deposits are very soft to medium stiff in consistency. One grain size analysis conducted on a sample of the deposits indicated the material is classified as A-4 under the AASHTO Soil Classification System and CL under the USCS. The natural water contents of the sample tested was approximately 34 percent.

One pH test conducted on a sample of the Marsh Deposits measured a pH of 5.27. An electrical resistivity test conducted on the same sample measured 1,864 ohm-cm.

One Atterberg limits test was conducted on a sample from the Marsh Deposits and the test indicated it is non-plastic.

5.3 Glacial Till

Glacial Till was encountered in the borings beneath either the Fill or Marsh Deposit. The thickness of the Glacial Till deposit encountered was approximately 2 to 14 feet. The Glacial Till varied from:

- Grey to grey-brown, SAND, some gravel, little to some silt;
- Grey, Sandy GRAVEL, some silt;
- Grey, GRAVEL, some sand, trace to some silt;
- Grey, Gravelly SILT, some sand; and
- Brown, Sandy SILT, little gravel.

One corrected SPT N-value within the fine-grained Glacial Till was greater than 50 bpf indicating the fine-grained Glacial Till is hard in consistency.

Corrected SPT N-values within the coarse-grained Glacial Till ranged from 28 to greater than 50 bpf indicating the deposit is medium dense to very dense in consistency.

Two grain size analyses performed on samples recovered from the deposit resulted in the material being classified as A-1-a and A-1-b under the AASHTO Soil Classification System and GW-GM and SW-SM under the USCS. The natural water contents of the samples tested were approximately 9 and 14 percent.

5.4 Bedrock

Bedrock was encountered and cored in five of the project borings. The table below summarizes borings in which bedrock was cored, the depth to bedrock, corresponding top of bedrock elevations and RQD's.

Boring	Station	Offset (feet)	Approximate Depth to Bedrock (feet)	Approximate Elevation of Bedrock Surface (feet)	RQD (%) (R1, R2, R3)
BB-CLTS-101	11+65.8	7.3 Lt	24.5	245.8	67
BB-CLTS-102	12+33.2	6.9 Rt	35.4	234.2	70, 83
BB-CLTS-201	11+53.9	6.1 Lt	20.0	250.5	69, 33
BB-CLTS-202	11+53.9	7.0 Rt	18.1	252.5	48, 83
BB-CLTS-203	12+43.6	6.2 Lt	18.1	251.3	85, 80, 85

Bedrock at the site consisted of light to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, joints dipping at moderate to steep angles, spaced close to moderately close. The RQD of the bedrock cores ranged from 33 to 85 percent, corresponding to a Rock Quality of poor to good.

Detailed bedrock descriptions and RQD's are provided in Appendix A – Boring Logs and on Sheets 4 and 5 – Boring Logs. Rock core photographs are provided in Appendix B – Rock Core Photographs.

Unconfined compressive strength (UCS) testing was conducted on two samples of bedrock, the results of which are summarized in the following table.

Boring	Depth Below Ground Surface (ft)	Unconfined Compressive Strength (psi)	Young's Modulus, E[1] (ksi)	Unit Weight (pcf)	Rock Type
BB-CLTS-202	21.52-21.87	5,451	4,910	173	Graywacke
BB-CLTS-203	19.25-19.62	23,452	3,220	170	Graywacke

5.5 Groundwater

Groundwater was measured at depths ranging from 11 to 16 feet below the roadway surface upon completion of the borings. Note that water was introduced into the boreholes during drilling operations and the measured levels may not represent stabilized groundwater elevations. Groundwater levels will fluctuate with seasonal changes, precipitation, runoff, river levels and construction activities.

[1] The Young's Modulus values listed in the table are reported at the initial failure or peak stress range. Reference the test reports in Appendix C – Laboratory Test Results for Young's Moduli reported at other stress ranges.

6.0 FOUNDATION ALTERNATIVES

Integral abutments founded on H-pile was the preferred substructure design due to cost, ease of construction, and reduced maintenance costs. Preliminary borings were drilled considering a shorter bridge span prior to the inclusion of wildlife shelves in the bridge design. Driven H-piles were anticipated at Abutment No. 2 until final borings indicated that pile at both abutments would need to be rock-socketed.

7.0 GEOTECHNICAL DESIGN CONSIDERATIONS AND RECOMMENDATIONS

The following sections provide geotechnical design considerations and recommendations for rock-socketed H-pile supported integral abutments which is the proposed substructure type for the Little Tomah Bridge replacement project.

7.1 Integral Abutment Rock-Socketed H-Piles

Abutments No. 1 and 2 will be integral abutments founded on a single row of rock-socketed H-piles. A minimum of 4 H-piles will be installed at each abutment.

Piles will be sized depending on the factored design axial loads, bending stresses and ability to resist lateral loads. H-piles shall be 50 ksi, Grade A572 steel. The selected pile section shall comply with the slenderness requirements of AASHTO LRFD Bridge Design Specifications 9th Edition (LRFD) Article 6.9.4.2 or alternatively, slender pile sections can be accounted for in the design process. The piles shall be fitted with a steel bearing plate sized to provide the required compressive resistance.

The minimum rock socket diameter will be 30-inch. The rock socket design will include a minimum 6-inch grout base beneath the pile bearing plate and a minimum 3-foot grout column encapsulating the bottom of the H-pile. The design shall allow for a minimum of 10-foot free length when measured from the bottom of the abutment stem to the top of the grout column. Lateral pile analyses may dictate the need for a longer free length to control bending stresses.

Estimated distances from the proposed bottom of abutment elevations to the top of rock are provided in the table below. Actual bedrock conditions may vary.

Abutment	Offset	Approximate Bottom Elevation of Proposed Abutment (feet)	Approximate Top of Bedrock Elevation (feet)	Estimated Distance from Bottom of Abutment to Top of Rock (feet)
Abutment No. 1	LT	259	250.5	8.5
Abutment No. 1	RT	259	252.5	6.5
Abutment No. 2	LT	259	251.3	7.7
Abutment No. 2	RT	259	250.2	8.8

7.1.1 Axial Pile Resistance – Strength Limit State

The design of rock-socketed H-piles at the strength limit state shall consider;

- structural resistance of piles in axial compression,
- structural resistance of piles in combined axial loading and flexure, and
- compressive axial geotechnical resistance of piles.

The pile groups shall be designed to resist all lateral earth loads, vehicular loads, dead and live loads, and lateral forces transferred through the pile caps.

Structural Resistance. Per LRFD Article 6.5.4.2, at the strength limit state, the axial resistance factor $\phi_c = 0.60$ shall be applied to the structural compressive resistance of the pile. Since the H-piles will be subjected to lateral loading, the piles shall also be checked for combined axial compression and flexure as prescribed in LRFD Articles 6.9.2.2 and 6.15.2. This design axial load may govern the design. Per LRFD Article 6.5.4.2, at the strength limit state, the axial resistance factor $\phi_c = 0.70$ and the flexural resistance factor $\phi_f = 1.0$ shall be applied to the combined axial and flexural resistance of the pile in the interaction equation (LRFD Eq. 6.9.2.2-1 or -2). H-piles shall also be analyzed for fixity using LPile® v2016 (LPile) software, or similar. It is the responsibility of the structural engineer to calculate the factored axial structural compressive resistances based on the lengths of the upper and lower unbraced pile segments, as determined from LPile, using a resistance factor of $\phi_c = 0.70$ for combined axial and bending and appropriate effective length factors (K). These resistances may be the controlling values.

Geotechnical Resistance. The axial geotechnical resistance of rock-socketed H-piles at the strength limit state shall be calculated using the methodology for drilled shafts end bearing in bedrock by computing a drilled shaft tip resistance in rock according to LRFD Article 10.8.3.5.4c. Bedrock below the base of the pile bearing elevation is to be assumed to be jointed, therefore LRFD Eq. 10.8.3.5.4c-2 shall be used. The uniaxial compressive strength assumed in the design shall be no greater than the average of the UCS tests provided in this report. A Licensed Geologist with experience in geotechnical engineering applications shall determine the Hoek-Brown strength parameters and Geological Strength Index (GSI) of the bedrock at the abutment locations. Per LRFD Table 10.5.5.2.4-1, at the strength limit state, a resistance factor of $\phi_{stat} = 0.50$ shall be applied to the compressive axial geotechnical resistance of the pile.

The governing axial pile resistance will be the lesser of the factored structural resistance and factored geotechnical resistance. The maximum applied factored axial pile load shall not exceed the governing factored axial pile resistance.

7.1.2 Axial Pile Resistance – Service and Extreme Limit State

The design of H-piles at the service limit state shall consider tolerable transverse and longitudinal movement of the piles and pile group movements/stability. For the service limit state, resistance factors of $\phi = 1.0$ shall be used in accordance with LRFD Article 10.5.5.1. The exception is the overall global stability of the foundation which shall be investigated at the Service I load combination and a resistance factor, ϕ, of 0.65.

Extreme limit state design checks for the rock-socketed H-piles shall include pile axial compressive resistance, overall global stability of the pile group, pile failure by uplift in tension, and structural failure. The extreme event load combinations are those related to extreme hydraulic and scour events. Resistance factors for extreme limit states, per LRFD Article 10.5.5.3, shall be taken as $\phi = 1.0$ with the exception of uplift of piles, for which the resistance factor, φ_{up}, shall be 0.80 or less per LRFD Article 10.5.5.3.2.

The maximum applied factored axial pile load for the service and extreme limit states shall not exceed the factored axial pile resistance.

7.1.3 Lateral Pile Resistance/Behavior

In accordance with LRFD Article 6.15.1 and LRFD Article 10.8.3.8, the structural analysis of pile groups subjected to lateral loads shall include explicit consideration of soil-structure interaction effects as specified in LRFD Article 10.7.3.12. A fixed condition at the pile tip shall also be confirmed with soil-structure interaction analyses. For shafts socketed into rock, the input properties used to determine the response of the rock to lateral loading shall assume the rock mass is fractured such that its intact shear strength is compromised following the guidance of LRFD Articles 10.4.6.4 and 10.8.2.3.

A series of lateral pile resistance analyses shall be performed to evaluate pile behavior at the abutments using LPile, or similar, software. The designer shall utilize the lateral pile analyses to evaluate the associated pile stresses, bending moments, and fixity due to factored pile head loads and displacements.

Geotechnical parameters for generation of soil-resistance (p-y) curves in lateral pile analyses shall be developed and provided with the rock-socketed Hpile design. The models developed shall emulate appropriate structural parameters and pile-head boundary conditions for the pile section(s) being analyzed.

7.1.1 Rock-Socketed Pile Quality Control

Rock-socketed piles shall be constructed in accordance with Special Provision 501 (Rock-Socketed H-Pile Foundations).

The rock socket shall be detailed such that grout can be reliably placed below and around the pile tip and promote, full, uniform load transfer to end bearing in bedrock. The detail shall include provisions to achieve the required grout base thickness beneath the bearing plate.

To prevent caving of existing soil deposits, the holes for rock-socketed pile shall be drilled through the overburden by advancing temporary casing with an inner diameter that is, at a minimum, the design diameter of the bedrock socket. The temporary casing shall be equipped with a cutting shoe capable of establishing a positive seal in bedrock to prevent soil and groundwater infiltration into the bedrock socket.

Rock sockets shall be cleaned of all loose material using an airlift or vacuum truck. The socket shall be inspected for cleanliness immediately prior to grout placement.

Tremie grout tubes detailed to remain permanently as part of the rock socket shall be filled with a non-shrink grout listed on the MaineDOT QPL.

The portion of the rock socket above the grout column shall be backfilled with aggregate meeting for the requirements of Subsection 703.22, Underdrain Backfill Material, Type C.

The rock sockets shall be constructed such that the piles meet the required positioning tolerances when centered in the drilled hole.

7.1.1 Corrosion Mitigation

Per LRFD Article 10.7.5, soils with a pH less than 5.5 and electrical resistivity less than 2,000 ohm-cm should be considered as indicative of a potential corrosion situation. A pH test conducted on a representative sample of the marsh deposit measured a pH of 5.27. A soil electrical resistivity test on the same sample measured 1,864 ohm-cm. The borings conducted at both Abutment No. 1 and Abutment No. 2 indicate the piles will be installed in the corrosive deposit. Therefore, corrosion mitigation countermeasures for piles installed at both abutments is required. The bridge design shall incorporate one of the following corrosion countermeasures at each rock-socketed H-pile:

1) Install a jointless HDPE isolation casing in accordance with Special Provision 501 (Pile Casings) from the bottom of the concrete pile jacket to the top of bedrock. The casing shall have a minimum inside diameter of 30 inches. The isolation casing may be extended to the bottom of the abutment stem and be used as the formwork for the concrete jacket.
2) Design the rock-socketed H-pile for an assumed section loss resulting from a corrosion rate of 0.0014 in/yr per side of steel, for the specified design life of the structure.

7.2 Integral Abutment and Wingwall Design

Integral abutment sections shall be designed for all relevant strength, service, and extreme limit states and load combinations specified in LRFD Articles 3.4.1 and 11.5.5. A resistance factor (ϕ) of 1.0 shall be used to assess abutment design at the service limit state, including: settlement and excessive horizontal movement. The overall stability of the foundation shall be investigated at the Service I Load Combination and a resistance factor, ϕ, of 0.65. Resistance factors for extreme limit state shall be taken as 1.0.

The designer shall assume Soil Type 4 (MaineDOT Bridge Design Guide (BDG) Section 3.6.1) for abutment backfill material soil properties. The backfill properties are as follows:

- Internal Friction Angle (ϕ) = 32°
- Total Unit Weight (γ) = 125 pcf
- Soil-Concrete Interface Friction Angle (δ) = 17° (ref: LRFD Table 3.11.5.3-1)

Integral abutments and in-line wingwalls shall be designed to withstand a lateral earth load equal to the passive pressure state. Estimation of passive earth pressure shall consider LRFD C3.11.5.4, which states that the relative wall movement to induce full passive pressure is approximately 0.05 for dense backfill, and FHWA NHI-06-089 Figure 10-4 which supports a K_p of 6.0 and greater for dense backfills and wall rotations equal to or greater than 0.02. This figure is reproduced in Appendix E – References.

The backfill slope at both abutments is negligible and may be assumed to be level. Using Rankine Theory, a lateral earth pressure coefficient of 3.3 shall be assumed, except when the ratio of lateral movement to wall height exceeds 0.004, in which case the passive earth pressure coefficient shall be determined from MassDOT LRFD Bridge Design Manual Figure 3.10.8-1. This figure is reproduced in Appendix E – References. A load factor for passive earth pressure is not specified in LRFD. For purposes of the integral abutment backwall reinforcing steel design, use a maximum load factor (γ_{EH}) of 1.50 to calculate factored passive earth pressures.

Additional lateral earth pressure due to live load surcharge is required per Section 3.6.8 of the MaineDOT BDG for abutments if an approach slab is not specified. When a structural approach slab is specified, reduction, not elimination of the surcharge load, is permitted per LRFD Article 3.11.6.5. The live load surcharge shall be estimated as a uniform horizontal earth pressure due to an equivalent height of soil (h_{eq}) taken from the table, below:

Abutment Height (feet)	h_{eq} (feet)
5	4.0
10	3.0
≥20	2.0

In-line wingwalls shall be designed considering a live load surcharge equal to a uniform horizontal earth pressure due to an equivalent height of soil of 2.0 feet. An at-rest earth pressure coefficient, K_o, of 0.47 shall be used for live load surcharge loads placed upon wingwalls cantilevered off of abutments with the top of the wall restrained from movement.

7.3 Abutment Sections

The abutment design shall include a drainage system behind the abutment to intercept any groundwater. Drainage behind the structure shall be in accordance with MaineDOT BDG Section 5.4.2.13.

Backfill within 10 feet of the abutments and side slope fill shall conform to MaineDOT Specification 703.19 – Granular Borrow for Underwater Backfill. The gradation of this material specifies 7 percent or less of the material passing the No. 200 sieve. Limiting the amount of fines is intended to minimize frost action and eliminate the need to design for hydrostatic forces by promoting drainage behind the structure.

Slopes in front of the pile-supported integral abutments shall be constructed with riprap and erosion control geotextile. The slopes shall not exceed 1.75H:1V in accordance with MaineDOT Standard Detail 610(03).

7.4 Settlement and Embankment Stability

The vertical alignment of the new Little Tomah Bridge will closely match the existing. The bridge approach embankments will be constructed using granular borrow placed over medium dense to very dense granular fill overlying primarily dense coarse-grained and hard fine-grained native soil deposits and bedrock. Any loose soils encountered at the subgrade elevation shall be thoroughly compacted prior to backfill operations. With these provisions, any settlement at the proposed bridge approaches is anticipated to be small and immediate.

Conventional earth fill embankments constructed over the existing soils using MaineDOT Standard Specifications, with side slopes of 2H:1V or flatter, are anticipated to satisfy stability requirements. Slopes steeper than 2H:1V shall be treated with riprap using MaineDOT standard details. Slopes shall be no steeper than 1.75H:1V.

Settlement of the steel H-piles bearing in bedrock will be limited to elastic compression of the piles and is anticipated to be minimal.

7.5 Frost Protection

Foundations placed on soil shall be designed with an appropriate embedment for frost protection. According to MaineDOT BDG Figure 5-1, Maine Design Freezing Index Map, Codyville has a design freezing index (DFI) of approximately 1850 F-degree days. The anticipated coarse-grained fill soil was assigned a water content of 10%. These components correlate to a frost depth of 7.6 feet. Any foundation bearing on soils shall be embedded 7.6 feet for frost protection.

Pile-supported integral abutments shall be embedded a minimum of 4.0 feet for frost protection per MaineDOT BDG Section 5.2.1.

Riprap is not to be considered as contributing to the overall thickness of soils required for frost protection.

7.6 Seismic Design Considerations

In conformance with LRFD Table 4.7.4.3-1 seismic analysis is not required for single-span bridges regardless of seismic zone.

8.0 CONSTRUCTION RECOMMENDATIONS AND CONSIDERATIONS

Any peat, organics, soft or loose soils encountered at the subgrade elevation at either abutment shall be excavated in its entirety and replaced with Granular Borrow – Material for Underwater Backfill and the exposed subgrade then thoroughly compacted.

Excavation for the abutments is anticipated to be accomplished using sloped open cut methods in accordance with MaineDOT and OSHA requirements. Excavations will expose soils that may become saturated and water seepage may occur during construction. There may be localized sloughing and instability in some excavations and cut slopes. The contractor should control groundwater, surface water infiltration, and soil erosion. Water should be controlled by pumping from sumps.

Previous structures at the bridge were founded on concrete abutments and log crib abutments partly filled with stone. Wood, concrete or stone may create obstructions for construction activities and will need to be removed by conventional excavation methods.

9.0 CLOSURE

This report has been prepared for the use of the MaineDOT Bridge Program for specific application to the proposed replacement of Little Tomah Bridge in Codyville Township, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

In the event that any changes in the nature, design, or location of the proposed project are planned, this report should be reviewed by a geotechnical engineer to assess the appropriateness of the conclusions and recommendations and to modify the recommendations as appropriate to reflect the changes in design. These analyses and recommendations are based in part upon limited subsurface investigations at discrete exploratory locations completed at the site. If variations from the conditions encountered during the investigation appear evident during construction, it may also become necessary to re-evaluate the recommendations made in this report.

It is recommended that a geotechnical engineer be provided the opportunity for a review of the final design and specifications in order that the earthwork and foundation recommendations and construction considerations presented in this report are properly interpreted and implemented in the design and specifications.

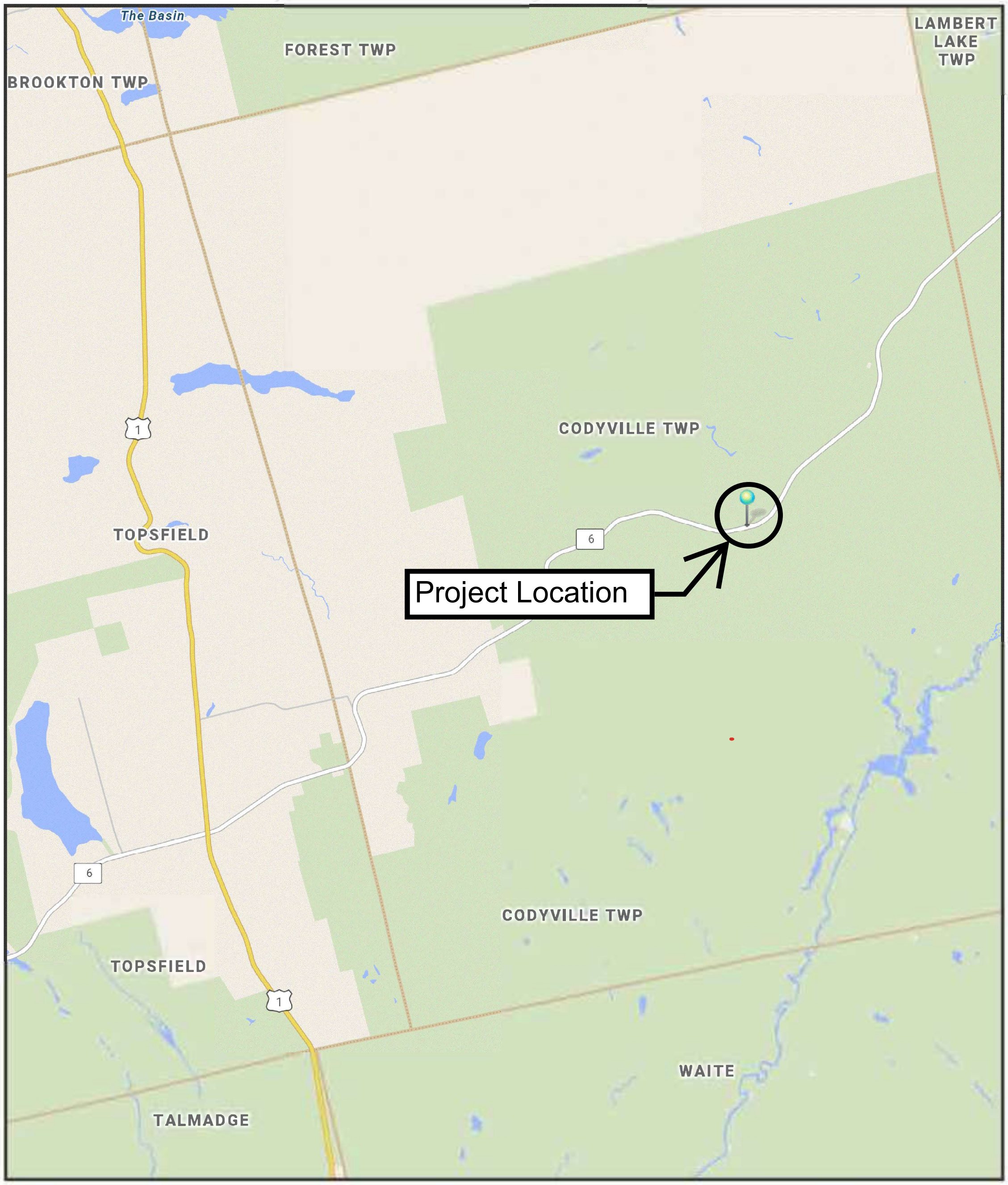
Sheets

Date:12/12/2024

Division: GEOTECH

Username: Terry.White

CODYVILLE, MAINE



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1.5 Miles

1 inch = 1.61 miles

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Time: 10:29:39 AM

SHEET NUMBER	LITTLE TOMAH BRIDGE LITTLE TOMAH STREAM CODYVILLE WASHINGTON CTY.	STATE OF MAINE DEPARTMENT OF TRANSPORTATION
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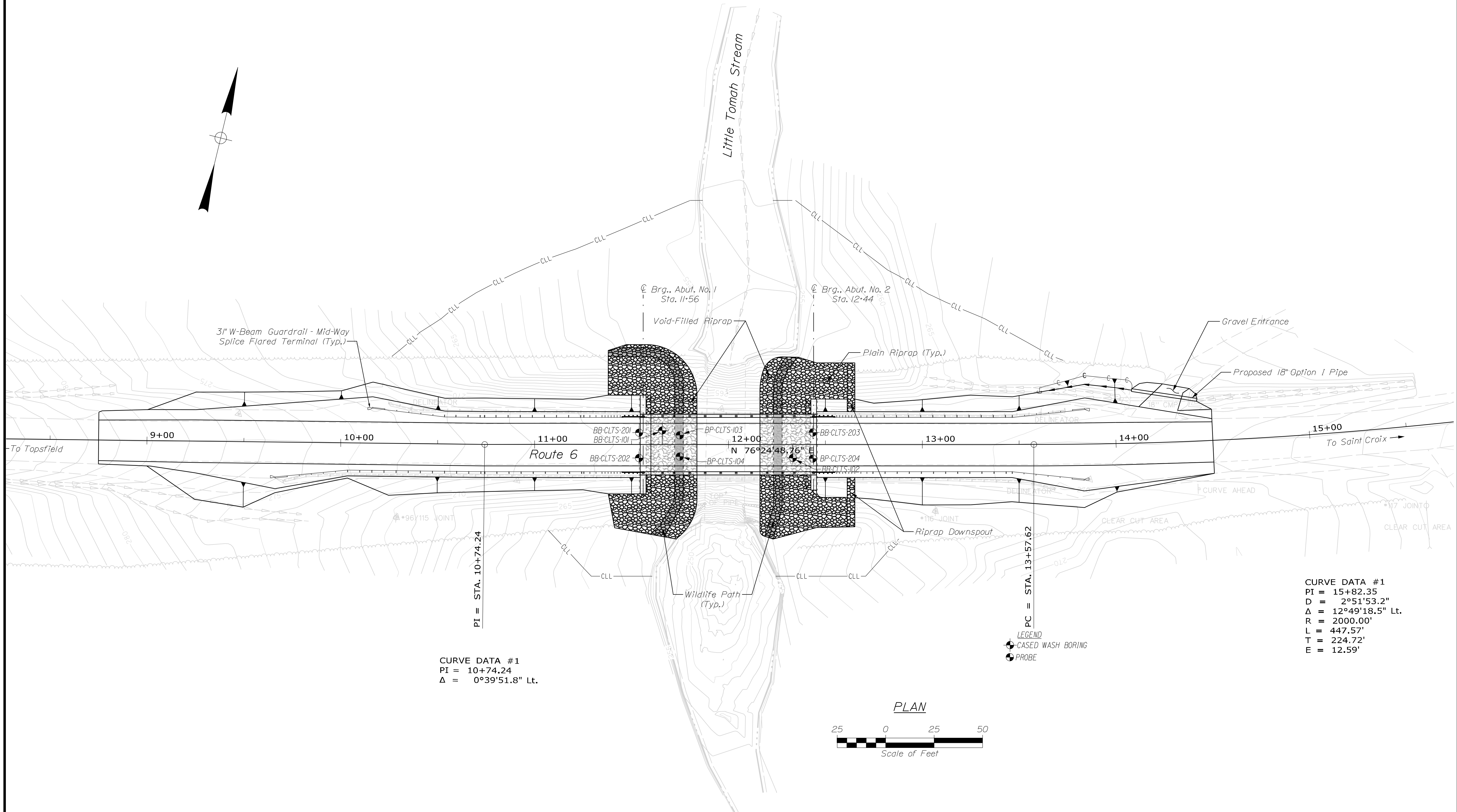
OF 5	LOCATION MAP	WIN BRIDGE NO. 2472 25387.00 BRIDGE PLANS



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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

2538700

WIN 25387.00

BRIDGE NO. 2472

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER	J. STETSON	
DESIGN-DETAILED	B. BARTLETT	JAN 2024
CHECKED-REVIEWED	D. SHAW	JAN 2024
DESIGN2-DETAILED2	N.PUKAY	JUL 2024
DESIGN3-DETAILED3	T.WHITE	JUL 2024
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

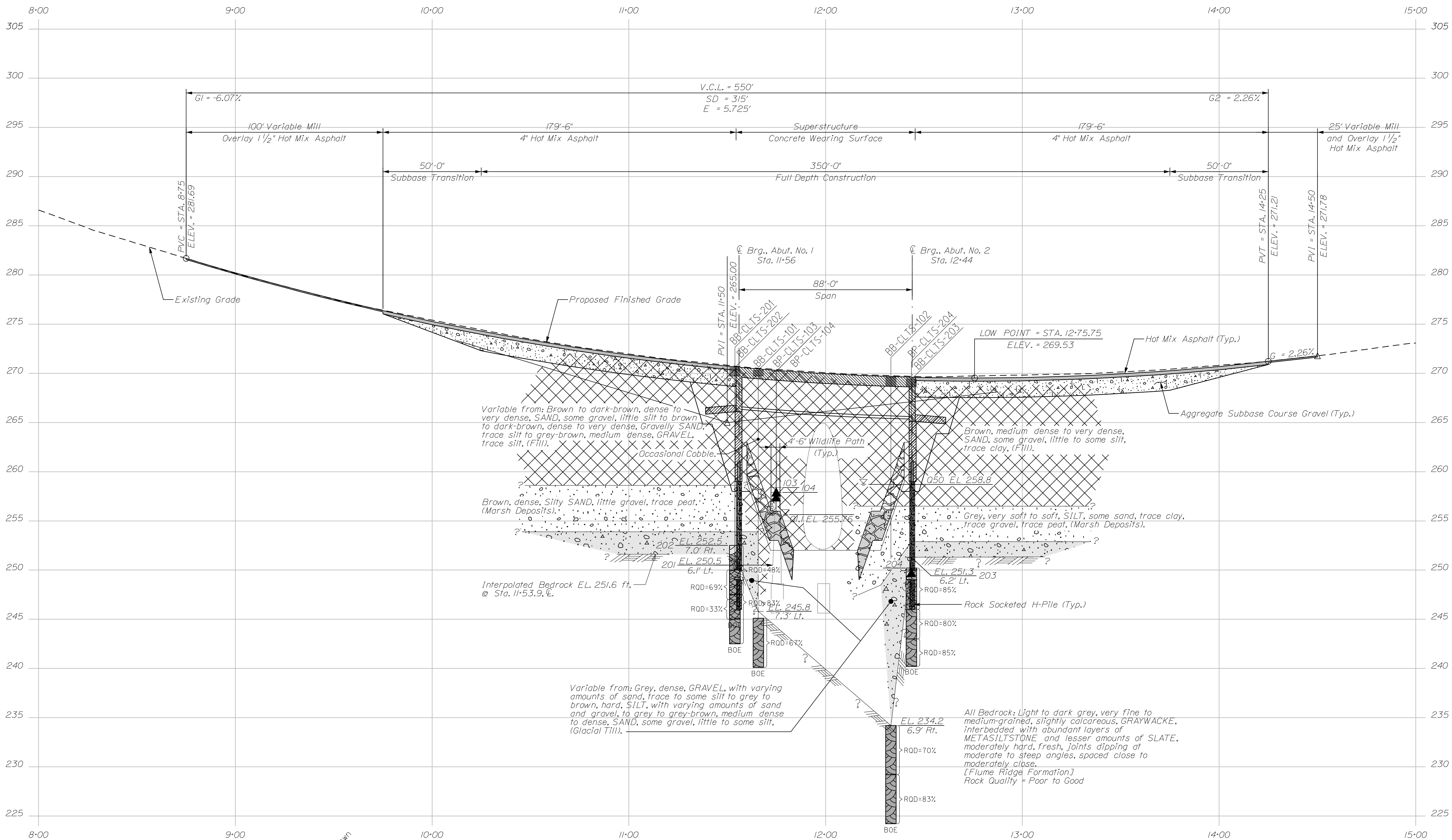
P.E. NUMBER

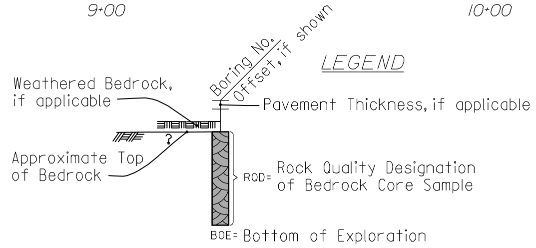
DATE

LITTLE TOMAH BRIDGE
LITTLE TOMAH STREAM
CODYVILLE WASHINGTON COUNTY

BORING LOCATION PLAN

SHEET NUMBER
2
OF 5





PROFILE

HORIZ 25 0 25 50
VERT 5 0 5 10
SCALE

Notes: 1) This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil and bedrock transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.

2) "Varying Amounts" term = Portion is 0 to 50 percent of Total.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

2538700

WIN 25387.00

BRIDGE PLANS

BRIDGE NO. 2472

	BY	DATE
PROJ. MANAGER	J. STETSON	
DESIGN-DETAILED	B. BARTLETT	JAN 2024
CHECKED-REVIEWED	D. SHAW	
DESIGN2-DETAILED2	N. PUKAY	FEB 2025
DESIGN3-DETAILED3	T. WHITE	
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE
P.E. NUMBER
DATE

LITTLE TOMAH BRIDGE
LITTLE TOMAH STREAM
CODYVILLE WASHINGTON COUNTY

INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER
3
OF 5

Filename: ...\00\GEOTECH\MSTA\006_ISP1.dgn Division: GEOTECH Username: Nathan.P.Pukay Date:2/28/2025

Filename: ...\MSTA\007_BORING LOGS1.dgn Division: GEOTECH Username: Nathan.P.Pukay Date:2/27/2025

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-101
WIN: 25387.00

Driller:	MaineDOT	Elevation (ft.)	270.3	Auger ID/OD:	5" Solid Stem
Operator:	Wilder/Daggett	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	N. Pukay	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	10/12/2022; 08:00-11:00	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	11+65.8, 7.3 ft Lt.	Casing ID/OD:	HW(4.0"/4.5")	Water Level*:	11.0 ft bgs
Hammer Efficiency Factor: 0.974		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in. Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	269.7	7" HMA. 0.6	
5	1D	24/19	5.00 - 7.00	15/16/17/41	33	54			Brown, dry, very dense, Gravelly SAND, trace silt, (Fill). Occasional cobble.	G#337517 A-1-a, SW-SM WC=5.4%
10	2D	24/22	10.00 - 12.00	16/14/13/15	27	44	69		Dark brown, dry, dense, Gravelly SAND, little silt, trace organics, (Fill).	
							59			
							27			
							21			
							18			
15	3D	24/5	15.00 - 17.00	4/3/5/11	8	13	11		Grey-brown, wet, medium dense, GRAVEL, trace silt, (Fill).	
							17			
							80	253.1	PEAT in wash at 17.0 ft bgs. 17.2	
							97			
							76			
20	4D	24/14	20.00 - 22.00	14/15/15/23	30	49	43		Grey, wet, dense, GRAVEL, some sand, trace silt, (Glacial Till).	G#337518 A-1-a, GW-GM WC=8.5%
							69			
							201			
							224			
							a175	245.8	a175 blows for 0.5 ft. 24.5	
25	R1	60/60	25.20 - 30.20	RQD = 67%			NQ-2		Top of Bedrock at Elev. 245.8 ft. Roller Coned ahead to 25.2 ft bgs. R1: Bedrock: Light to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately dipping joints, closely spaced. [Flume Ridge Formation] Rock Quality = Fair R1: Core Times (min:sec) 25.2-26.2 ft (1:50) 26.2-27.2 ft (1:40) 27.2-28.2 ft (3:09) 28.2-29.2 ft (2:09) 29.2-30.2 ft (2:59) 100% Recovery Note: Core barrel broke during R1. R1 core was obtained. Outer shell of core barrel left in hole at 23.2-30.2 BGS (El. 247.1 to El. 240.1). 30.2	
30								240.1	Bottom of Exploration at 30.2 feet below ground surface.	
35										
40										
45										
50										

Remarks:

Core Barrel broke during R1. Outer steel shell of core barrel left in hole at 23.2-30.2 ft bgs (El. 247.1 - El. 240.1)

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1

Boring No.: BB-CLTS-101

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-102
WIN: 25387.00

Driller:	MaineDOT	Elevation (ft.)	269.6	Auger ID/OD:	5" Solid Stem
Operator:	Wilder/Daggett	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	N. Pukay	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	10/11/2022; 10:45-14:00	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	12+33.2, 6.9 ft Rt.	Casing ID/OD:	HW(4.0"/4.5")	Water Level*:	16.0 ft bgs
Hammer Efficiency Factor: 0.974		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in. Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	268.7	11" HMA. 0.9	
5	1D	24/20	5.00 - 7.00	12/17/20/17	37	60			Brown, dry, very dense, SAND, some gravel, little silt, (Fill).	G#337519 A-1-b, SM WC=5.0%
10	2D	24/18	10.00 - 12.00	4/4/5/5	9	15	16		Brown, moist, medium dense, SAND, some silt, some gravel, trace clay, (Fill).	G#337520 A-2-4, SC-SM WC=13.9%
							17			
							16	256.6	13.0	
							8			
							8			
15	3D	24/15	15.00 - 17.00	2/WOR/WOR/WOR	---		9		Grey, wet, very soft, SILT, some sand, trace clay, trace gravel, (Marsh Deposits).	G#337521 A-4, CL WC=33.9% Non-Plastic
							11			
							12		Dark brown PEAT observed in wash at 17.0 ft bgs.	
							14			
							20			
20	4D	24/14	20.00 - 22.00	3/4/13/16	17	28	40			
							61	248.3	21.3 4D: Grey, wet, medium dense, SAND, some gravel, little silt, trace peat, (Glacial Till).	G#337522 A-1-B, SW-SM WC=14.1%
							75			
							74			
							70			
25	5D	24/14	25.00 - 27.00	11/23/33/37	56	91	62		Grey, wet, very dense, Sandy GRAVEL, some silt, (Glacial Till).	
							69			
							86			
							96			
							121			
30	6D	24/18	30.00 - 32.00	40/59/47/48	106	172	47		Grey, wet, very dense, GRAVEL, some silt, some sand, (Glacial Till).	
							48			
							85			
							110			
							111			
35	7D R1	5/1 60/60	35.00 - 35.42 35.40 - 40.40	RQD = 70%			a55 NQ-2	234.2	a55 blows for 5". Grey, wet, very dense, GRAVEL (Bedrock), trace silt. 35.4 Top of Bedrock at Elev. 234.2 ft. R1: Bedrock: Light to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately dipping joints, spaced moderately close. [Flume Ridge Formation] Rock Quality = Fair R1: Core Times (min:sec) 35.4-36.4 ft (1:45) 36.4-37.4 ft (1:47) 37.4-38.4 ft (2:00) 38.4-39.4 ft (1:55) 39.4-404 ft (3:10) 100% Recovery	
40	R2	60/60	40.40 - 45.40	RQD = 83%					R2: Bedrock: Similar to R1, except with several quartz or calcite annealed fractures. [Flume Ridge Formation] Rock Quality = Good R2: Core Times (min:sec) 40.4-41.4 ft (1:28) 41.4-42.4 ft (1:47) 42.4-43.4 ft (1:20) 43.4-44.4 ft (1:24) 44.4-45.4 ft (1:29) 100% Recovery	
45								224.2	45.4 Bottom of Exploration at 45.4 feet below ground surface.	
50										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1

Boring No.: BB-CLTS-102

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BP-CLTS-103
WIN: 25387.00

Drilling Contractor:	MaineDOT	Elevation (ft.)	270.2	Auger ID/OD:	5" Dia.
Operator:	Wilder/Daggett	Datum:	NAVD88	Sampler:	N/A
Logged By:	N. Pukay	Rig Type:	CME 45C	Hammer Wt./Fall:	N/A
Date Start/Finish:	10/12/2022-10/12/2022	Drilling Method:	Solid Stem Auger	Core Barrel:	N/A
Boring Location:	11+74.9, 4.8 ft Lt.	Casing ID/OD:	N/A	Water Level*:	None Observed

Definitions:
D = Split Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in. Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA		Boring probe. Fill spoils observed on auger flights.	
5									
10							258.4	11.8 Bottom of Exploration at 11.8 feet below ground surface. REFUSAL. Concrete dust on auger tip.	
15									
20									
25									

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1

Boring No.: BP-CLTS-103

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BP-CLTS-104
WIN: 25387.00

Drilling Contractor:	MaineDOT	Elevation (ft.)	270.2	Auger ID/OD:	5" Dia.
Operator:	Wilder/Daggett	Datum:	NAVD88	Sampler:	N/A
Logged By:	N. Pukay	Rig Type:	CME 45C	Hammer Wt./Fall:	N/A
Date Start/Finish:	10/12/2022-10/12/2022	Drilling Method:	Solid Stem Auger	Core Barrel:	N/A
Boring Location:	11+74.9, 6.2 ft Rt.	Casing ID/OD:	N/A	Water Level*:	None Observed

Definitions:
D = Split Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in. Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA		Boring probe. Fill spoils observed on auger flights.	
5									
10							257.9	12.3 Bottom of Exploration at 12.3 feet below ground surface. REFUSAL. Concrete dust on auger tip and bottom flight.	
15									
20									
25									

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1

Boring No.: BP-CLTS-104

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

2538700

BRIDGE NO. 2472

WIN 25387.00

BRIDGE PLANS

		BY	DATE
PROJ. MANAGER	J. STETSON		
DESIGN-DETAILED	B. BARTLETT	D. SHAW	JAN 2024
CHECKED-REVIEWED	-----	-----	
DESIGN2-DETAILED2	N.PUKAY	T.WHITE	FEB 2025
DESIGN3-DETAILED3	-----	-----	-----
REVISIONS 1	-----	-----	-----
REVISIONS 2	-----	-----	-----
REVISIONS 3	-----	-----	-----
REVISIONS 4	-----	-----	-----
FIELD CHANGES	-----	-----	-----

SIGNATURE

P.E. NUMBER

DATE

LITTLE TOMAH BRIDGE
LITTLE TOMAH STREAM
CODYVILLE WASHINGTON COUNTY

BORING LOGS

SHEET NUMBER

4

OF 5

Filename: ...\MSTAV008_BORING LOGS2.dgn Division: GEOTECH Username: Nathan.P.Pukay Date:2/27/2025

Maine Department of Transportation — Soil/Rock Exploration Log — US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-201 | WIN: 25387.00

Driller:	S.W. Cole	Elevation (ft.)	270.5	Auger ID/OD:	5" Solid Stem
Operator:	Hanscom/Wall	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	N. Pukay	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	1/8/2024; 11:30-13:00	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	11+53.9, 6.1 ft Lt.	Casing ID/OD:	HW(4.0"/4.5")	Water Level*:	None Observed
Hammer Efficiency Factor: 1.066		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
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HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N60	Casing Blows	Elevation (ft.)
0							SSA	
10							SPUN HW	
20	R1	36/36	20.50 - 23.50	RQD = 69%			~~RC~~ NQ-2	250.5
23.5	R2	24/20	23.50 - 25.50	RQD = 33%				245.0

Visual Description and Remarks:

Top of Bedrock at Elev. 250.5 ft. —20.0
Roller Coned ahead to 20.5 ft bgs.
R1: Bedrock: Light grey to dark grey, fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately to steeply dipping joints, closely spaced.
[Flume Ridge Formation]
Rock Quality = Fair
R1: Core Times (min:sec)
20.5-21.5 ft (3:02)
21.5-22.5 ft (3:15)
22.5-23.5 ft (3:28)
100% Recovery

R2: Bedrock: Light grey to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, steeply dipping joints, closely spaced.
[Flume Ridge Formation]
Rock Quality = Poor
R2: Core Times (min:sec)
23.5-24.5 ft (3:26)
24.5-25.5 ft (3:38)
83% Recovery —25.5

Bottom of Exploration at 25.5 feet below ground surface.

Remarks:
Hammer #367

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1 — Boring No.: BB-CLTS-201

Maine Department of Transportation — Soil/Rock Exploration Log — US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-202 | WIN: 25387.00

Driller:	S.W. Cole	Elevation (ft.)	270.6	Auger ID/OD:	5" Solid Stem
Operator:	Hanscom/Wall	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	N. Pukay	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	1/9/2024; 08:45-11:15	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	11+53.9, 7.0 ft Rt.	Casing ID/OD:	NW(3.0"/3.5")	Water Level*:	11.0 ft bgs.
Hammer Efficiency Factor: 1.066		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N60	Casing Blows	Elevation (ft.)
0							SSA	269.8
5	1D	24/10	5.00 - 7.00	15/16/21/14	37	66		
10	2D	24/9	10.00 - 12.00	16/11/10/7	21	37		258.6
15	3D/A	24/12	15.00 - 17.00	8/9/9/11	18	32	9	254.6
							27	
17	4D	13.2/8	17.00 - 18.10	12/29/50(1.2")	---		39	252.5
18.1	R1	60/60	18.10 - 23.10	RQD = 48%			a25 NQ-2	
23.1	R2	60/60	23.10 - 28.10	RQD = 83%				242.5

Visual Description and Remarks:

10" HMA. —0.8

Brown, moist, very dense, SAND, some gravel, little silt, (Fill).

Similar to 1D, except dense. Material change observed in tip of spoon. —12.0

Material on auger flights from 12.0-15.0 ft bgs: Brown, wet, Silty SAND, trace gravel, (Marsh Deposits).

3D (Top 3") Brown, wet, dense, Silty SAND, little gravel, (Marsh Deposits). —16.0

3D/A (Bottom 9") Grey-brown, wet, dense, SAND, some gravel, some silt, (Glacial Till).
Brown, wet, Sandy SILT, little gravel, (Glacial Till).
a25 blows for 0.1 ft. —18.1

Top of Bedrock at Elev. 252.5 ft.
R1: Bedrock: Light grey to dark grey, fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, steeply dipping joints, closely spaced, with some calcite infilling.
[Flume Ridge Formation]
Rock Quality = Poor
R1: Core Times (min:sec)
18.1-19.1 ft (4:18)
19.1-20.1 ft (3:37)
20.1-21.1 ft (3:35)
21.1-22.1 ft (4:04)
22.1-23.1 ft (6:02)
100% Recovery

R2: Bedrock: Similar to R1, except more competent.
[Flume Ridge Formation]
Rock Quality = Good
R2: Core Times (min:sec)
23.1-24.1 ft (6:02)
24.1-25.1 ft (4:03)
25.1-26.1 ft (3:05)
26.1-27.1 ft (2:54)
27.1-28.1 ft (3:10)
100% recovery —28.1

Bottom of Exploration at 28.1 feet below ground surface.

Laboratory Testing Results/AASHTO and Unified Class: #318503 21.52-21.87 q_p=5,451 psi

Remarks:
Hammer #367

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1 — Boring No.: BB-CLTS-202

Maine Department of Transportation — Soil/Rock Exploration Log — US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-203 | WIN: 25387.00

Driller:	S.W. Cole	Elevation (ft.)	269.4	Auger ID/OD:	5" Solid Stem
Operator:	Hanscom/Wall	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	N. Pukay	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	1/8/2024; 08:45-11:00	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	12+43.6, 6.2 ft Lt.	Casing ID/OD:	HW(4.0"/4.5")	Water Level*:	13.0 ft bgs.
Hammer Efficiency Factor: 1.066		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N60	Casing Blows	Elevation (ft.)
0							SSA	268.7
5	1D	24/10	5.00 - 7.00	11/20/20/11	40	71		
10	2D	24/8	10.00 - 12.00	6/6/5/15	11	20		
13							45	256.4
							19	
15	3D	24/14	15.00 - 17.00	WOH/WOH/4/40	4	7	RC	252.9
17	4D	3/3	17.00 - 17.25	50(3")	---			251.3
19.2	R1	50.4/50.4	19.20 - 23.40	RQD = 85%			NQ-2	
23.4	R2	36/34	23.40 - 26.40	RQD = 80%				
26.4	R3	33.6/29	26.40 - 29.20	RQD = 85%				240.2

Visual Description and Remarks:

9" HMA. —0.8

Brown, moist, very dense, SAND, some gravel, little silt, (Fill).

Similar to 1D, except medium dense. —13.0

Grey, wet, medium stiff, SILT, some sand, trace clay, trace gravel, (Marsh Deposits). —16.5

Grey, wet, hard, Gravelly SILT, some sand, (Glacial Till). —18.1

Top of Bedrock at Elev. 251.3 ft.
Roller Coned ahead to 19.2 ft bgs.

R1: Light grey to dark grey, fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately to steeply dipping joints, closely spaced.
[Flume Ridge Formation]
Rock Quality = Good
R1: Core Times (min:sec)
19.2-20.2 ft (3:29)
20.2-21.2 ft (3:28)
21.2-22.2 ft (3:27)
22.2-23.2 ft (5:26)
23.2-23.4 ft (2:20)
100% Recovery

R2: Bedrock: Similar to R1, except fine-grained.
[Flume Ridge Formation]
Rock Quality = Good
R2: Core Times (min:sec)
23.4-24.2 ft (3:05)
24.2-25.2 ft (3:45)
25.2-26.2 ft (3:54)
26.2-26.4 ft (2:05)
94% Recovery

R3: Bedrock: Similar to R1.
[Flume Ridge Formation]
Rock Quality = Good
R3: Core Times (min:sec)
26.4-27.2 ft (3:05)
27.2-28.2 ft (3:54)
28.2-29.2 ft (4:05)
86% Recovery;

6" of core left in hole —29.2

Bottom of Exploration at 29.2 feet below ground surface.

Laboratory Testing Results/AASHTO and Unified Class:
#318503 pH=5.27 Resistivity: 1,864 ohm-cm
#318503 19.25-19.62 q_p=23,452 psi

Remarks:
Hammer #367

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Page 1 of 1 — Boring No.: BB-CLTS-203

Maine Department of Transportation — Soil/Rock Exploration Log — US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BP-CLTS-204 | WIN: 25387.00

Drilling Contractor:	S.W. Cole	Elevation (ft.)	269.5	Auger ID/OD:	5" Dia.
Operator:	Hanscom/Wall	Datum:	NAVD88	Sampler:	N/A
Logged By:	N. Pukay	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	N/A
Date Start/Finish:	1/8/2024; 13:00-14:30	Drilling Method:	Solid Stem Auger	Core Barrel:	N/A
Boring Location:	12+43.6, 7.2 ft Rt.	Casing ID/OD:	N/A	Water Level*:	None Observed

Definitions:
D = Split Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)
0						SSA	
19.3							250.2

Visual Description and Remarks:

Boring probe. No material descriptions. —19.3

Bottom of Exploration at 19.3 feet below ground surface.
Auger REFUSAL, presumed bedrock.

Remarks:
Hammer #367

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Page 1 of 1 — Boring No.: BP-CLTS-204

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
2538700
BRIDGE NO. 2472 — WIN 25387.00 — BRIDGE PLANS

PROJ. MANAGER	J. STETSON	BY	DATE
DESIGN-DETAILED	B. BARTLETT	D. SHAW	JAN 2024
CHECKED-REVIEWED	-----	-----	
DESIGN2-DETAILED2	N.PUKAY	T.WHITE	FEB 2025
DESIGN3-DETAILED3	-----	-----	-----
REVISIONS 1	-----	-----	-----
REVISIONS 2	-----	-----	-----
REVISIONS 3	-----	-----	-----
REVISIONS 4	-----	-----	-----
FIELD CHANGES	-----	-----	-----

SIGNATURE
P.E. NUMBER
DATE

LITTLE TOMAH BRIDGE
LITTLE TOMAH STREAM
CODYVILLE WASHINGTON COUNTY

BORING LOGS

SHEET NUMBER 5 OF 5

Appendix A

Boring Logs

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-101
WIN: 25387.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	270.3	**Auger ID/OD:**	5" Solid Stem
Operator:	Wilder/Daggett	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/12/2022; 08:00-11:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	11+65.8, 7.3 ft Lt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	11.0 ft bgs

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA	269.7		7" HMA. 0.6	
5	1D	24/19	5.00 - 7.00	15/16/17/41	33				Brown, dry, very dense, Gravelly SAND, trace silt, (Fill).	G#337517 A-1-a, SW-SM WC=5.4%
									Occasional cobble.	
10	2D	24/22	10.00 - 12.00	16/14/13/15	27	69			Dark brown, dry, dense, Gravelly SAND, little silt, trace organics, (Fill).	
						59				
						27				
						21				
						18				
15	3D	24/5	15.00 - 17.00	4/3/5/11	8	11			Grey-brown, wet, medium dense, GRAVEL, trace silt, (Fill).	
						17				
						80	253.1		PEAT in wash at 17.0 ft bgs. 17.2	
						97				
						76				
20	4D	24/14	20.00 - 22.00	14/15/15/23	30	43			Grey, wet, dense, GRAVEL, some sand, trace silt, (Glacial Till).	G#337518 A-1-a, GW-GM WC=8.5%
						69				
						201				
						224				
						a175	245.8		a175 blows for 0.5 ft. 24.5	
25										

Remarks:

Core Barrel broke during R1. Outer steel shell of core barrel left in hole at 23.2-30.2 ft bgs (El. 247.1 - El. 240.1)

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-101
WIN: 25387.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	270.3	**Auger ID/OD:**	5" Solid Stem
Operator:	Wilder/Daggett	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/12/2022; 08:00-11:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	11+65.8, 7.3 ft Lt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	11.0 ft bgs

Definitions: D = Spilt Spoon Sample
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V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	R1	60/60	25.20 - 30.20	RQD = 67%		NQ-2			Top of Bedrock at Elev. 245.8 ft. Roller Coned ahead to 25.2 ft bgs. R1: Bedrock: Light to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately dipping joints, closely spaced. [Flume Ridge Formation] Rock Quality = Fair R1: Core Times (min:sec) 25.2-26.2 ft (1:50) 26.2-27.2 ft (1:40) 27.2-28.2 ft (3:09) 28.2-29.2 ft (2:09) 29.2-30.2 ft (2:59) 100% Recovery Note: Core barrel broke during R1. R1 core was obtained. Outer shell of core barrel left in hole at 23.2-30.2 BGS (El. 247.1 to El. 240.1).	
30							240.1		30.2 **Bottom of Exploration at 30.2 feet below ground surface.**	
35										
40										
45										
50										

Remarks:

Core Barrel broke during R1. Outer steel shell of core barrel left in hole at 23.2-30.2 ft bgs (El. 247.1 - El. 240.1)

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-102
WIN: 25387.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	269.6	**Auger ID/OD:**	5" Solid Stem
Operator:	Wilder/Daggett	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/11/2022; 10:45-14:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+33.2, 6.9 ft Rt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	16.0 ft bgs

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA			11" HMA.	
							268.7		0.9	
5	1D	24/20	5.00 - 7.00	12/17/20/17	37				Brown, dry, very dense, SAND, some gravel, little silt, (Fill).	G#337519 A-1-b, SM WC=5.0%
10	2D	24/18	10.00 - 12.00	4/4/5/5	9	16			Brown, moist, medium dense, SAND, some silt, some gravel, trace clay, (Fill).	G#337520 A-2-4, SC-SM WC=13.9%
						17				
						16	256.6		13.0	
						8				
						8				
15	3D	24/15	15.00 - 17.00	2/WOR/WOR/WOR	---	9			Grey, wet, very soft, SILT, some sand, trace clay, trace gravel, (Marsh Deposits).	G#337521 A-4, CL WC=33.9% Non-Plastic
						11			Dark brown PEAT observed in wash at 17.0 ft bgs.	
						12				
						14				
						20				
20	4D	24/14	20.00 - 22.00	3/4/13/16	17	40				
						61	248.3		21.3 4D: Grey, wet, medium dense, SAND, some gravel, little silt, trace peat, (Glacial Till).	G#337522 A-1-B, SW-SM WC=14.1%
						75				
						74				
25						70				

Remarks:

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* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-102
WIN: 25387.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	269.6	**Auger ID/OD:**	5" Solid Stem
Operator:	Wilder/Daggett	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	10/11/2022; 10:45-14:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+33.2, 6.9 ft Rt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	16.0 ft bgs

Definitions: D = Spilt Spoon Sample; S = Sample off Auger Flights; B = Bucket Sample off Auger Flights; MD = Unsuccessful Split Spoon Sample Attempt; U = Thin Wall Tube Sample; MV = Unsuccessful Field Vane Shear Test Attempt; V = Field Vane Shear Test, PP= Pocket Penetrometer; MU = Unsuccessful Thin Wall Tube Sample Attempt; R = Rock Core Sample; SSA = Solid Stem Auger; HSA = Hollow Stem Auger; RC = Roller Cone; WOH = Weight of 140lb. Hammer; WOR/C = Weight of Rods or Casing; WO1P = Weight of 1 Person; S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf); $S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf); q_p = Unconfined Compressive Strength (ksf); N-value = Raw Field SPT N-value; T_v = Pocket Torvane Shear Strength (psf); WC = Water Content, percent ≅ = Similar or Equal too; LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index; G = Grain Size Analysis; C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	5D	24/14	25.00 - 27.00	11/23/33/37	56	62			Grey, wet, very dense, Sandy GRAVEL, some silt, (Glacial Till).	
						69				
						86				
						96				
						121				
30	6D	24/18	30.00 - 32.00	40/59/47/48	106	47			Grey, wet, very dense, GRAVEL, some silt, some sand, (Glacial Till).	
						48				
						85				
						110				
						111				
35	7D R1	5/1 60/60	35.00 - 35.42 35.40 - 40.40	RQD = 70%		a55 NQ-2	234.2		a55 blows for 5". Grey, wet, very dense, GRAVEL (Bedrock), trace silt. 35.4 Top of Bedrock at Elev. 234.2 ft. R1: Bedrock: Light to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately dipping joints, spaced moderately close. [Flume Ridge Formation] Rock Quality = Fair R1: Core Times (min:sec) 35.4-36.4 ft (1:45) 36.4-37.4 ft (1:47) 37.4-38.4 ft (2:00) 38.4-39.4 ft (1:55) 39.4-404 ft (3:10) 100% Recovery	
40	R2	60/60	40.40 - 45.40	RQD = 83%					R2: Bedrock: Similar to R1, except with several quartz or calcite annealed fractures. [Flume Ridge Formation] Rock Quality = Good R2: Core Times (min:sec) 40.4-41.4 ft (1:28) 41.4-42.4 ft (1:47) 42.4-43.4 ft (1:20) 43.4-44.4 ft (1:24) 44.4-45.4 ft (1:29) 100% Recovery	
45							224.2		45.4 **Bottom of Exploration at 45.4 feet below ground surface.**	
50										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log

US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-201

WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	270.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/8/2024; 11:30-13:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	11+53.9, 6.1 ft Lt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample; S = Sample off Auger Flights; B = Bucket Sample off Auger Flights; MD = Unsuccessful Split Spoon Sample Attempt; U = Thin Wall Tube Sample; MV = Unsuccessful Field Vane Shear Test Attempt; V = Field Vane Shear Test, PP= Pocket Penetrometer; MU = Unsuccessful Thin Wall Tube Sample Attempt; R = Rock Core Sample; SSA = Solid Stem Auger; HSA = Hollow Stem Auger; RC = Roller Cone; WOH = Weight of 140lb. Hammer; WOR/C = Weight of Rods or Casing; WO1P = Weight of 1 Person; S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf); $S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf); q_p = Unconfined Compressive Strength (ksf); N-value = Raw Field SPT N-value; T_v = Pocket Torvane Shear Strength (psf); WC = Water Content, percent ≅ = Similar or Equal too; LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index; G = Grain Size Analysis; C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA				
5										
10						SPUN HW				
15										
20	R1	36/36	20.50 - 23.50	RQD = 69%		RC NQ-2	250.5		20.0 Top of Bedrock at Elev. 250.5 ft. Roller Coned ahead to 20.5 ft bgs. R1: Bedrock: Light grey to dark grey, fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately to steeply dipping joints, closely spaced. [Flume Ridge Formation] Rock Quality = Fair R1: Core Times (min:sec) 20.5-21.5 ft (3:02)	
	R2	24/20	23.50 - 25.50	RQD = 33%						
25										

Remarks:

Hammer #367

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-201
WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	270.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/8/2024; 11:30-13:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	11+53.9, 6.1 ft Lt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							245.0		21.5-22.5 ft (3:15) 22.5-23.5 ft (3:28) 100% Recovery R2: Bedrock: Light grey to dark grey, very fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, steeply dipping joints, closely spaced. [Flume Ridge Formation] Rock Quality = Poor R2: Core Times (min:sec) 23.5-24.5 ft (3:26) 24.5-25.5 ft (3:38) 83% Recovery 25.5 **Bottom of Exploration at 25.5 feet below ground surface.**	
30										
35										
40										
45										
50										

Remarks:

Hammer #367

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-202
WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	270.6	**Auger ID/OD:**	5" Solid Stem
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/9/2024; 08:45-11:15	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	11+53.9, 7.0 ft Rt.	**Casing ID/OD:**	NW(3.0"/3.5")	**Water Level*:**	11.0 ft bgs.

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA			10" HMA.	
							269.8		0.8	
5	1D	24/10	5.00 - 7.00	15/16/21/14	37				Brown, moist, very dense, SAND, some gravel, little silt, (Fill).	
10	2D	24/9	10.00 - 12.00	16/11/10/7	21				Similar to 1D, except dense. Material change observed in tip of spoon.	
							258.6		12.0	
									Material on auger flights from 12.0-15.0 ft bgs: Brown, wet, Silty SAND, trace gravel, (Marsh Deposits).	
15	3D/A	24/12	15.00 - 17.00	8/9/9/11	18	9			3D (Top 3") Brown, wet, dense, Silty SAND, little gravel, (Marsh Deposits).	
						27	254.6		16.0	
									3D/A (Bottom 9") Grey-brown, wet, dense, SAND, some gravel, some silt, (Glacial Till).	
	4D	13.2/8	17.00 - 18.10	12/29/50(1.2"))	---	39			Brown, wet, Sandy SILT, little gravel, (Glacial Till).	
	R1	60/60	18.10 - 23.10	RQD = 48%		a25 NQ-2	252.5		a25 blows for 0.1 ft.	
									18.1	
20									Top of Bedrock at Elev. 252.5 ft. R1: Bedrock: Light grey to dark grey, fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, steeply dipping joints, closely spaced, with some calcite infilling. [Flume Ridge Formation] Rock Quality = Poor R1: Core Times (min:sec) 18.1-19.1 ft (4:18) 19.1-20.1 ft (3:37) 20.1-21.1 ft (3:35) 21.1-22.1 ft (4:04) 22.1-23.1 ft (6:02)	#318503 21.52-21.87 q_p=5,451 psi
	R2	60/60	23.10 - 28.10	RQD = 83%						
25										

Remarks:

Hammer #367

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-202
WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	270.6	**Auger ID/OD:**	5" Solid Stem
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/9/2024; 08:45-11:15	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	11+53.9, 7.0 ft Rt.	**Casing ID/OD:**	NW(3.0"/3.5")	**Water Level*:**	11.0 ft bgs.

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25									100% Recovery	
									R2: Bedrock: Similar to R1, except more competent. [Flume Ridge Formation] Rock Quality = Good R2: Core Times (min:sec)	
							242.5		23.1-24.1 ft (6:02) 24.1-25.1 ft (4:03) 25.1-26.1 ft (3:05) 26.1-27.1 ft (2:54) 27.1-28.1 ft (3:10)	
30									100% recovery	
									28.1	
									Bottom of Exploration at 28.1 feet below ground surface.	
35										
40										
45										
50										

Remarks:

Hammer #367

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-203
WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	269.4	**Auger ID/OD:**	5" Solid Stem
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/8/2024; 08:45-11:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+43.6, 6.2 ft Lt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	13.0 ft bgs.

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA		9" HMA.	
0.8							268.7		
5	1D	24/10	5.00 - 7.00	11/20/20/11	40			Brown, moist, very dense, SAND, some gravel, little silt, (Fill).	
10	2D	24/8	10.00 - 12.00	6/6/5/15	11			Similar to 1D, except medium dense.	
13.0							256.4		
						45			
						19			#318503 pH=5.27 Resistivity: 1,864 ohm-cm
15	3D	24/14	15.00 - 17.00	WOH/WOH/4/40	4	RC		Grey, wet, medium stiff, SILT, some sand, trace clay, trace gravel, (Marsh Deposits).	
16.5							252.9		
	4D	3/3	17.00 - 17.25	50(3")	---			Grey, wet, hard, Gravelly SILT, some sand, (Glacial Till).	
18.1							251.3	Top of Bedrock at Elev. 251.3 ft. Roller Coned ahead to 19.2 ft bgs.	
	R1	50.4/50.4	19.20 - 23.40	RQD = 85%		NQ-2		R1: Light grey to dark grey, fine to medium-grained, slightly calcareous, GRAYWACKE, interbedded with abundant layers of METASILTSTONE and lesser amounts of SLATE, moderately hard, fresh, moderately to steeply dipping joints, closely spaced. [Flume Ridge Formation] Rock Quality = Good R1: Core Times (min:sec) 19.2-20.2 ft (3:29) 20.2-21.2 ft (3:28) 21.2-22.2 ft (3:27) 22.2-23.2 ft (5:26)	#318503 19.25-19.62 q_p=23,452 psi
20									
	R2	36/34	23.40 - 26.40	RQD = 80%					
25									

Remarks:

Hammer #367

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BB-CLTS-203
WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	269.4	**Auger ID/OD:**	5" Solid Stem
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/8/2024; 08:45-11:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	12+43.6, 6.2 ft Lt.	**Casing ID/OD:**	HW(4.0"/4.5")	**Water Level*:**	13.0 ft bgs.

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
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MD = Unsuccessful Split Spoon Sample Attempt
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MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25									23.2-23.4 ft (2:20) 100% Recovery	
	R3	33.6/29	26.40 - 29.20	RQD = 85%					R2: Bedrock: Similar to R1, except fine-grained. [Flume Ridge Formation] Rock Quality = Good R2: Core Times (min:sec) 23.4-24.2 ft (3:05) 24.2-25.2 ft (3:45) 25.2-26.2 ft (3:54) 26.2-26.4 ft (2:05) 94% Recovery	
							240.2			
30									R3: Bedrock: Similar to R1. [Flume Ridge Formation] Rock Quality = Good R3: Core Times (min:sec) 26.4-27.2 ft (3:05) 27.2-28.2 ft (3:54) 28.2-29.2 ft (4:05) 86% Recovery; 6" of core left in hole	
									29.2	
35									**Bottom of Exploration at 29.2 feet below ground surface.**	
40										
45										
50										

Remarks:

Hammer #367

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BP-CLTS-103
WIN: 25387.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	270.2	**Auger ID/OD:**	5" Dia.
Operator:	Wilder/Daggett	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	N. Pukay	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	10/12/2022-10/12/2022	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	11+74.9, 4.8 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA			Boring probe. Fill spoils observed on auger flights.	
5										
10										
							258.4		11.8	
									Bottom of Exploration at 11.8 feet below ground surface. REFUSAL. Concrete dust on auger tip.	
15										
20										
25										

Remarks:

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Boring No.: BP-CLTS-103

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BP-CLTS-104
WIN: 25387.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	270.2	**Auger ID/OD:**	5" Dia.
Operator:	Wilder/Daggett	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	N. Pukay	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	10/12/2022-10/12/2022	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	11+74.9, 6.2 ft Rt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA			Boring probe. Fill spoils observed on auger flights.	
5										
10										
12.3							257.9		**Bottom of Exploration at 12.3 feet below ground surface.** REFUSAL. Concrete dust on auger tip and bottom flight.	
15										
20										
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Little Tomah Bridge #2472 carries Route 6 over Little Tomah Stream
Location: Codyville Township, Maine

Boring No.: BP-CLTS-204
WIN: 25387.00

Drilling Contractor:	S.W. Cole	**Elevation (ft.)**	269.5	**Auger ID/OD:**	5" Dia.
Operator:	Hanscom/Wall	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	N. Pukay	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	1/8/2024; 13:00-14:30	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	12+43.6, 7.2 ft Rt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of 1 Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA			Boring probe. No material descriptions.	
5										
10										
15										
							250.2		19.3	
									Bottom of Exploration at 19.3 feet below ground surface. Auger REFUSAL, presumed bedrock.	
20										
25										

Remarks:

Hammer #367

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Appendix B

Rock Core Photographs

MaineDOT
Little Tomah Bridge #2472 Carries Route 6 Over Little Tomah Stream
Codyville Township, ME
Rock Core Photographs

Boring No.	Run	Depth (ft)	Penetration (in)	Recovery (in)	RQD (in)	RQD (%)	Rock Type	Box Row
BB-CLTS-102	R1	35.4-40.4	60	60	42	70	GRAYWACKE	1
BB-CLTS-102	R2	40.4-45.4	60	60	50	83	GRAYWACKE	2
BB-CLTS-101	R1	25.2-30.2	60	60	40	67	GRAYWACKE	3

Notes: 1. “Box row” indicates the section of the box where the core run is contained: 1 = top, 4 = bottom.
2. Top of each core run is on the left and increases with depth to the right.

MaineDOT

MaineDOT
Little Tomah Bridge #2472 Carries Route 6 Over Little Tomah Stream
Codyville Township, ME
Rock Core Photographs

Boring No.	Run	Depth (ft)	Penetration (in)	Recovery (in)	RQD (in)	RQD (%)	Rock Type	Box Row
BB-CLTS-201	R1	20.5-23.5	36	36	25	69	GRAYWACKE	1
BB-CLTS-201	R2	23.5-25.5	24	20	8	33	GRAYWACKE	1
BB-CLTS-202	R1	18.1-23.1	60	60	29	48	GRAYWACKE	2
BB-CLTS-202	R2	23.1-28.1	60	60	50	83	GRAYWACKE	3

Notes: 1. "Box row" indicates the section of the box where the core run is contained: 1 = top, 4 = bottom.
2. Top of each core run is on the left and increases with depth to the right.

MaineDOT

MaineDOT
Little Tomah Bridge #2472 Carries Route 6 Over Little Tomah Stream
Codyville Township, ME
Rock Core Photographs

Boring No.	Run	Depth (ft)	Penetration (in)	Recovery (in)	RQD (in)	RQD (%)	Rock Type	Box Row
BB-CLTS-203	R1	19.2-23.4	50.4	50.4	43	85	GRAYWACKE	1
BB-CLTS-203	R2	23.4-26.4	36	34	50	80	GRAYWACKE	2
BB-CLTS-203	R3	26.4-29.2	33.6	29	29	85	GRAYWACKE	3

Notes: 1. "Box row" indicates the section of the box where the core run is contained: 1 = top, 4 = bottom.
2. Top of each core run is on the left and increases with depth to the right.

Appendix C

Laboratory Test Results

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Codyville Township Work Number: 25387.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-CLTS-101, 1D	11+65.8	7.3 Lt.	5.0-7.0	337517	1	5.4			SW-SM	A-1-a	0
BB-CLTS-101, 4D	11+65.8	7.3 Lt.	20.0-22.0	337518	1	8.5			GW-GM	A-1-a	0
BB-CLTS-102, 1D	12+33.2	6.9 Rt.	5.0-7.0	337519	1	5.0			SM	A-1-b	II
BB-CLTS-102, 2D	12+33.2	6.9 Rt.	10.0-12.0	337520	1	13.9			SC-SM	A-2-4	III
BB-CLTS-102, 3D	12+33.2	6.9 Rt.	15.0-17.0	337521	1	33.9	N	P	CL	A-4	IV
BB-CLTS-102, 4D	12+33.2	6.9 Rt.	21.3-22.0	337522	1	14.1			SW-SM	A-1-b	0
BB-CLTS-203, 3D	12+43.6	6.2 Lt	15.0-17.0	318503	pH 5.27						
BB-CLTS-203, 3D	12+43.6	6.2 Lt	15.0-17.0	318503	Electrical Resistivity 1,864 ohm-cm						
BB-CLTS-203, 3D	12+43.6	6.2 Lt	15.0-17.0	318503	Electrical Conductivity 5.36E-04 $(ohm\text{-}cm)^{-1}$						

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MaineDOT and Corps of Engineers Classification Systems.

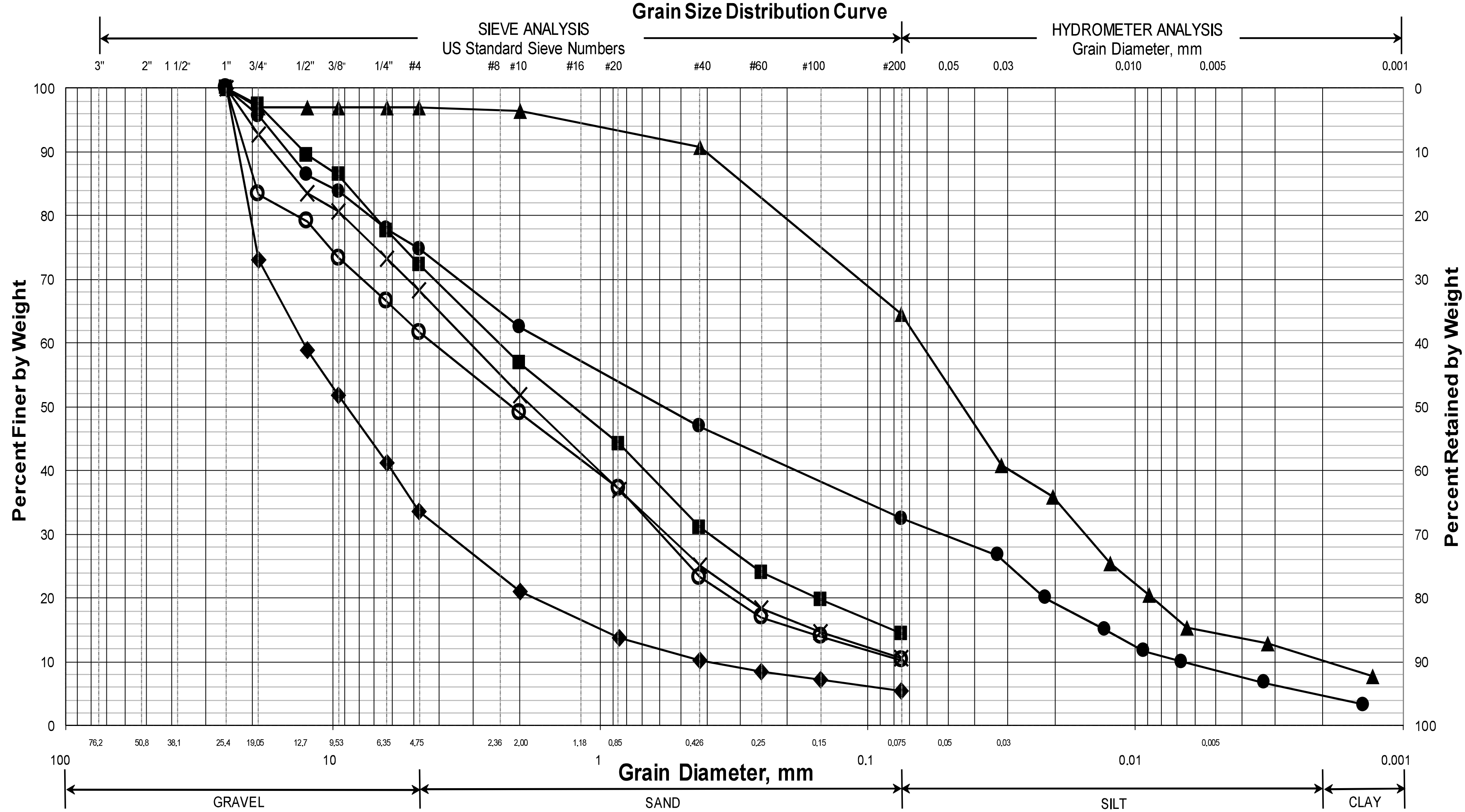
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98 NP = Non Plastic

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

Maine Department of Transportation
Grain Size Distribution Curve



UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	WC, %	LL	PL	PI
○	BB-CLTS-101/1D	11+65.8	7.3 LT	5.0-7.0	Gravelly SAND, trace silt.	5.4			
◆	BB-CLTS-101/4D	11+65.8	7.3 LT	20.0-22.0	GRAVEL, some sand, trace silt.	8.5			
■	BB-CLTS-102/1D	12+33.2	6.9 RT	5.0-7.0	SAND, some gravel, little silt.	5			
●	BB-CLTS-102/2D	12+33.2	6.9 RT	10.0-12.0	SAND, some silt, some gravel, trace clay.	13.9			
▲	BB-CLTS-102/3D	12+33.2	6.9 RT	15.0-17.0	SILT. some sand, trace clay, trace gravel.	33.9			NP
×	BB-CLTS-102/4D	12+33.2	6.9 RT	21.3-22.0	SAND, some gravel, little silt.	14.1			

WIN	
025387.00	
Town	
Codyville Twp	
Reported by/Date	
WHITE, TERRY A	12/2/2022

SHEET 1

Client:	Maine Department of Transportation
Project Name:	Little Tomah Bridge #2471
Project Location:	Codyville Township, ME
GTX #:	318503
Test Date:	02/05/24
Tested By:	kgs
Checked By:	ank

Laboratory pH of Soil by ASTM G51

Boring ID	Sample ID	Depth, ft	Description	Soil Temperature, ° C	Average pH Reading
CC-CLTS-203	3D	15-17	Moist, gray silt with gravel	21	5.27

Notes:

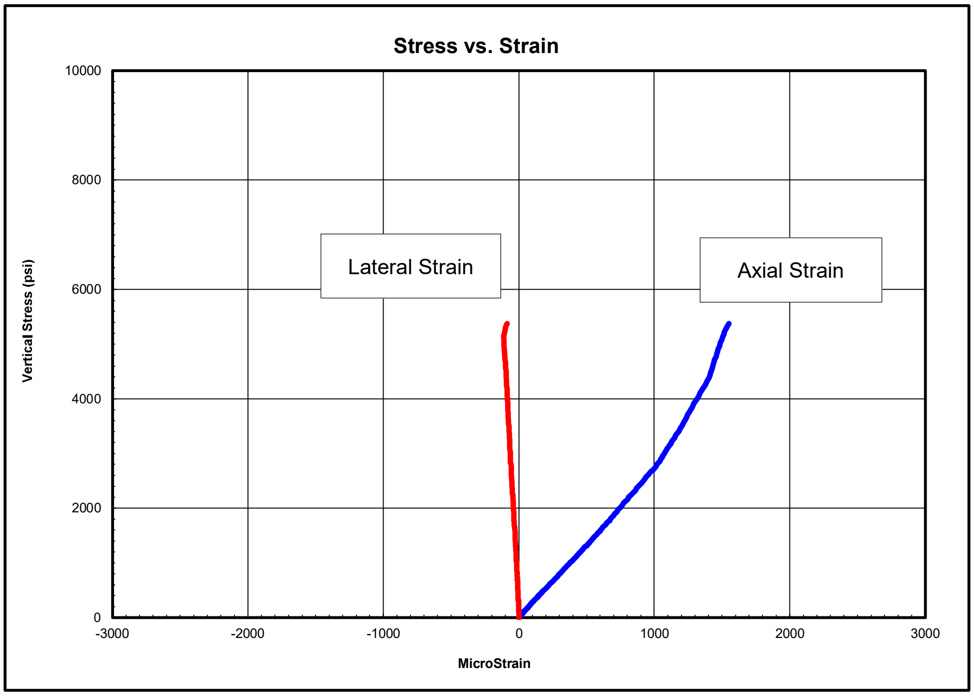
Client:	Maine Department of Transportation
Project:	Little Tomah Bridge #2472
Location:	Codyville Township, ME
GTX#:	318503
Test Date:	02/06/24
Due Date:	02/09/24
Tested By:	NMK
Checked By:	ank

Laboratory Measurement of Soil Resistivity Using the Wenner Four-Electrode Method by ASTM G57 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(ohm\text{-}cm)^{-1}$
BB_CLTS_203	3D	15-17 ft	Moist, gray silt with gravel	1,864	5.36E-04

Client:	Maine Department of Transportation
Project Name:	Little Tomah Bridge #2472
Project Location:	Codyville Township, ME
GTX #:	318503
Test Date:	2/21/2024
Tested By:	te
Checked By:	jsc
Boring ID:	BB-CLTS-202
Sample ID:	R1
Depth, ft:	21.52-21.87
Sample Type:	rock core
Sample Description:	See photographs Intact material and discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 5,451 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
500-2000	2,660,000	0.06
2000-3500	3,220,000	0.07
3500-4900	4,910,000	0.11

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

GeoTesting EXPRESS

Client:	Maine Department of Transportation	Test Date:	2/19/2024
Project Name:	Little Tomah Bridge #2472	Tested By:	gp
Project Location:	Codyville Township, ME	Checked By:	smd
GTX #:	318503		
Boring ID:	BB-CLTS-202		
Sample ID:	R1		
Depth:	21.52-21.87 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.27	4.27	4.27		
Specimen Diameter, in:	1.97	1.97	1.97		
Specimen Mass, g:	591.94				
Bulk Density, lb/ft^3	173			**Minimum Diameter Tolerence Met?**	**YES**
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00040	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030	0.00030	0.00040	0.00050
Diameter 2, in (rotated 90°)	-0.00090	-0.00070	-0.00060	-0.00040	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00040	0.00060	0.00070	0.00080	0.00090

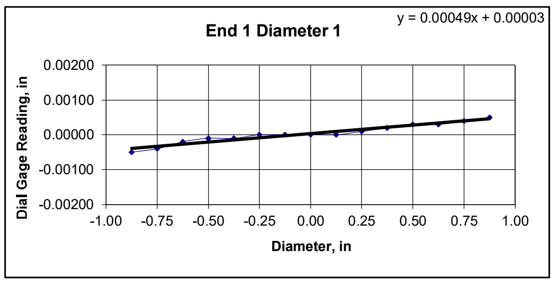
Difference between max and min readings, in:
0° = 0.00100 90° = 0.00180

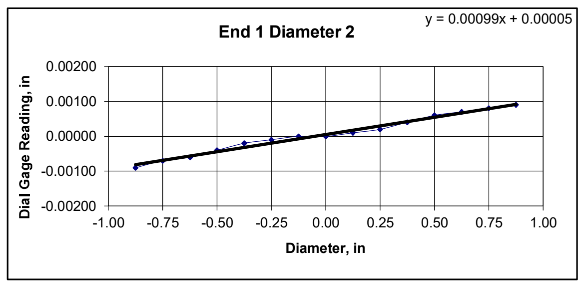
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00050	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020	0.00030	0.00050
Diameter 2, in (rotated 90°)	0.00090	0.00080	0.00070	0.00050	0.00040	0.00030	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00050	-0.00070	-0.00090

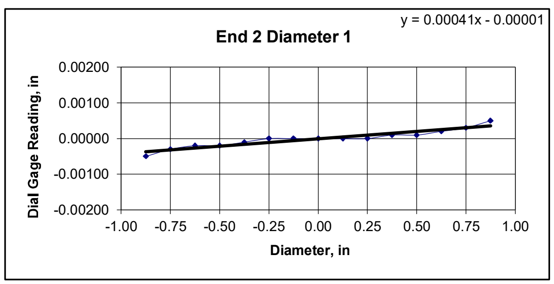
Difference between max and min readings, in:
0° = 0.001 90° = 0.0018

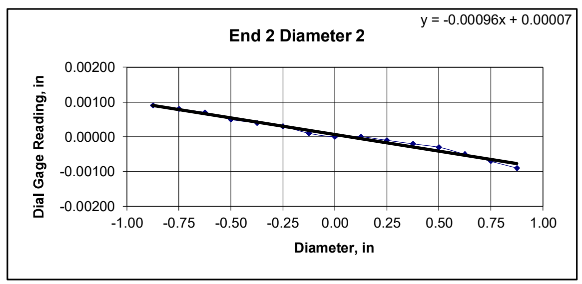
Maximum difference must be < 0.0020 in. Difference = ± 0.00090

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00049
Angle of Best Fit Line: 0.02783

End 2:
Slope of Best Fit Line 0.00041
Angle of Best Fit Line: 0.02357

Maximum Angular Difference: 0.00426

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00099
Angle of Best Fit Line: 0.05664

End 2:
Slope of Best Fit Line 0.00096
Angle of Best Fit Line: 0.05484

Maximum Angular Difference: 0.00180

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00100	1.970	0.00051	0.029	YES
Diameter 2, in (rotated 90°)	0.00180	1.970	0.00091	0.052	YES
END 2					
Diameter 1, in	0.00100	1.970	0.00051	0.029	YES
Diameter 2, in (rotated 90°)	0.00180	1.970	0.00091	0.052	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

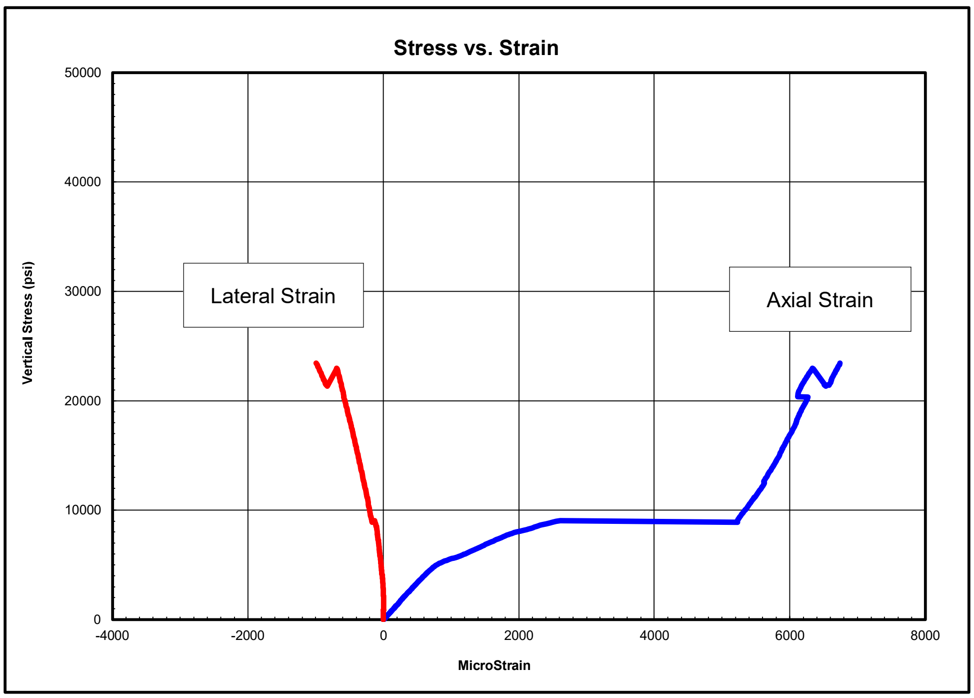
Client:	Maine Department of Transportation
Project Name:	Little Tomah Bridge #2472
Project Location:	Codyville Township, ME
GTX #:	318503
Test Date:	2/21/2024
Tested By:	te
Checked By:	smd
Boring ID:	BB-CLTS-202
Sample ID:	R1
Depth, ft:	21.52-21.87

After cutting and grinding

After break

Client:	Maine Department of Transportation
Project Name:	Little Tomah Bridge #2472
Project Location:	Codyville Township, ME
GTX #:	318503
Test Date:	2/21/2024
Tested By:	te
Checked By:	jsc
Boring ID:	BB-CLTS-203
Sample ID:	R1
Depth, ft:	19.25-19.62
Sample Type:	rock core
Sample Description:	See photographs Intact material failure Best Effort end preparation performed

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 23,452 psi

An initial failure occurred after the first stress range. The data the strain gauges recorded until total failure is in the graph above but was not used to calculate Young's Modulus and Poisson's Ratio for the second and third stress ranges.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
2300-8600	3,220,000	0.06
8600-14900	---	---
14900-21100	---	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Maine Department of Transportation		Test Date:	2/19/2024
Project Name:	Little Tomah Bridge #2472		Tested By:	gp
Project Location:	Codyville Township, ME		Checked By:	smd
GTX #:	318503			
Boring ID:	BB-CLTS-203			
Sample ID:	R1			
Depth:	19.25-19.62 ft			
Visual Description:	See photographs			

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.22	4.22	4.22		
Specimen Diameter, in:	1.97	1.97	1.97		
Specimen Mass, g:	575.55				
Bulk Density, lb/ft^3	170			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.1			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00090	0.00080	0.00070	0.00050	0.00040	0.00030	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00070	-0.00090

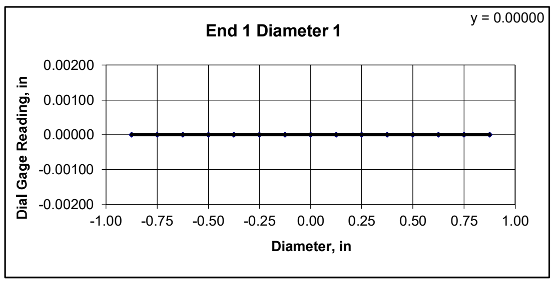
Difference between max and min readings, in:
0° = 0.00000 90° = 0.00180

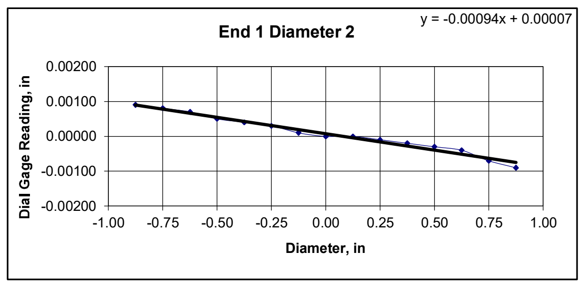
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	-0.00110	-0.00100	-0.00080	-0.00060	-0.00040	-0.00030	-0.00010	0.00000	0.00010	0.00030	0.00050	0.00070	0.00080	0.00100	0.00110

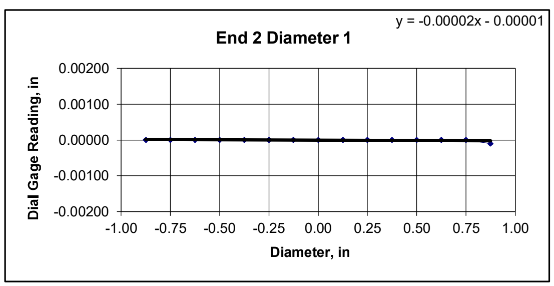
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0022

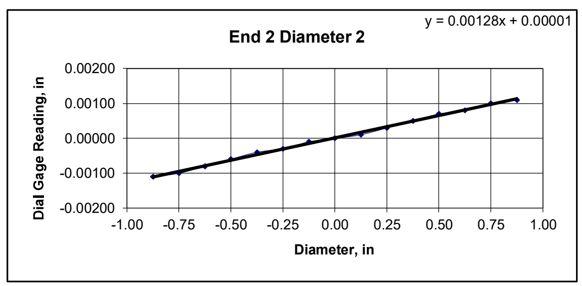
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00110

Flatness Tolerance Met? NO









DIAMETER 1

End 1:		
	Slope of Best Fit Line	0.00000
	Angle of Best Fit Line:	0.00000
End 2:		
	Slope of Best Fit Line	0.00002
	Angle of Best Fit Line:	0.00115
Maximum Angular Difference:		0.00115

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:		
	Slope of Best Fit Line	0.00094
	Angle of Best Fit Line:	0.05402
End 2:		
	Slope of Best Fit Line	0.00128
	Angle of Best Fit Line:	0.07317
Maximum Angular Difference:		0.01915

Parallelism Tolerance Met? NO
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00000	1.970	0.00000	0.000	YES
Diameter 2, in (rotated 90°)	0.00180	1.970	0.00091	0.052	YES
END 2					
Diameter 1, in	0.00010	1.970	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00220	1.970	0.00112	0.064	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Maine Department of Transportation	Test Date:	2/19/2024
Project Name:	Little Tomah Bridge #2472	Tested By:	gp
Project Location:	Codyville Township, ME	Checked By:	smd
GTX #:	318503		
Boring ID:	BB-CLTS-203	Reliable dial gauge measurements could not be performed on this rock type. Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	R1		
Depth (ft):	19.25-19.62		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS

END 1

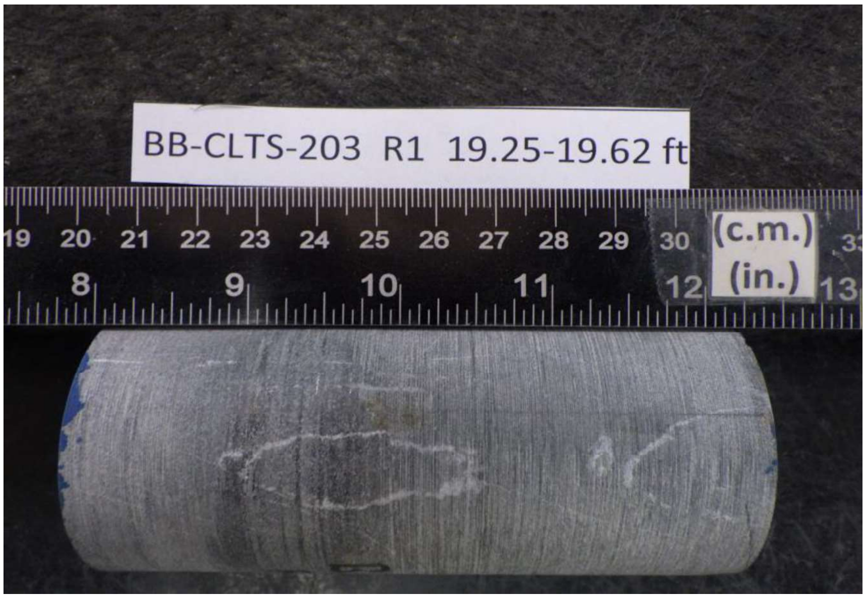
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90^{o})	Is the maximum gap $\leq \pm 0.001$ in.?	YES

END 2

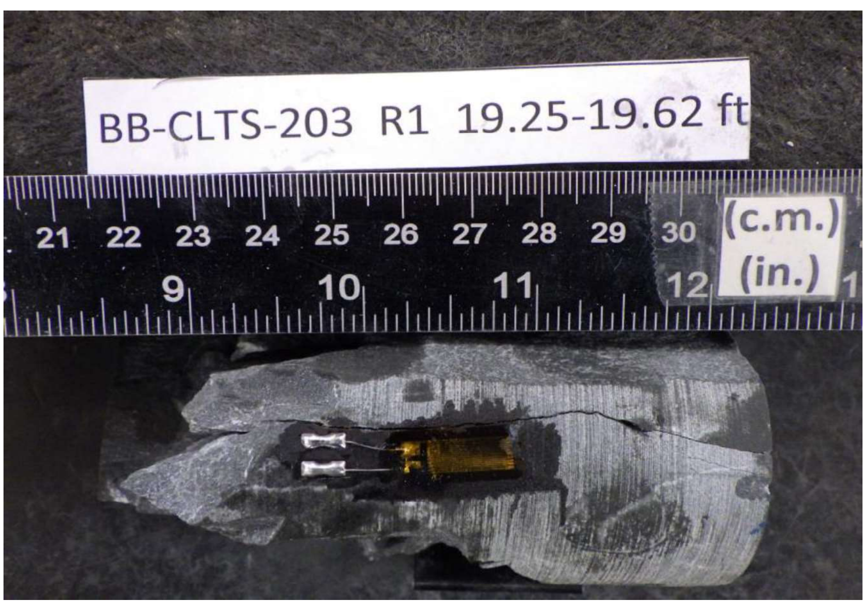
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90^{o})	Is the maximum gap $\leq \pm 0.001$ in.?	YES

End Flatness Tolerance Met? YES

Client:	Maine Department of Transportation
Project Name:	Little Tomah Bridge #2472
Project Location:	Codyville Township, ME
GTX #:	318503
Test Date:	2/21/2024
Tested By:	te
Checked By:	smd
Boring ID:	BB-CLTS-203
Sample ID:	R1
Depth, ft:	19.25-19.62



After cutting and grinding



After break

Appendix D

Calculations

Frost Depth

Method 1 - MaineDOT Design Freezing Index (DFI) Map and Depth of Frost Penetration Table, BDG Section 5.2.1.

From Design Freezing Index Map: Codyville, Maine
DFI = 1850 degree-days.
Coarse-Grained Fill w=10% (BB-CLTS-101 1D, BB-CLTS-102 1D + 2D)

Coarse-Grained Fill

For DFI = 1800, Coarse-Grained Soil, w=10%

$DFI_1 := 1800 \quad d_1 := 90.1in$

d=Depth of Frost Penetration

For DFI = 1900, Coarse-Grained Soil, w=10%

$DFI_2 := 1900 \quad d_2 := 92.6in$

Interpolate for DFI = 1850, Coarse-Grained Soil, w=10%

$DFI_3 := 1850$

$$d_{coarse} := d_1 + \left(DFI_3 - DFI_1\right)\cdot\frac{\left(d_2 - d_1\right)}{\left(DFI_2 - DFI_1\right)}$$

$d_{coarse} = 91.4\cdot in$ $\quad d_{coarse} = 7.6\cdot ft$

Recommend any foundation bearing on soil be embedded 7.6 **feet** for frost protection.

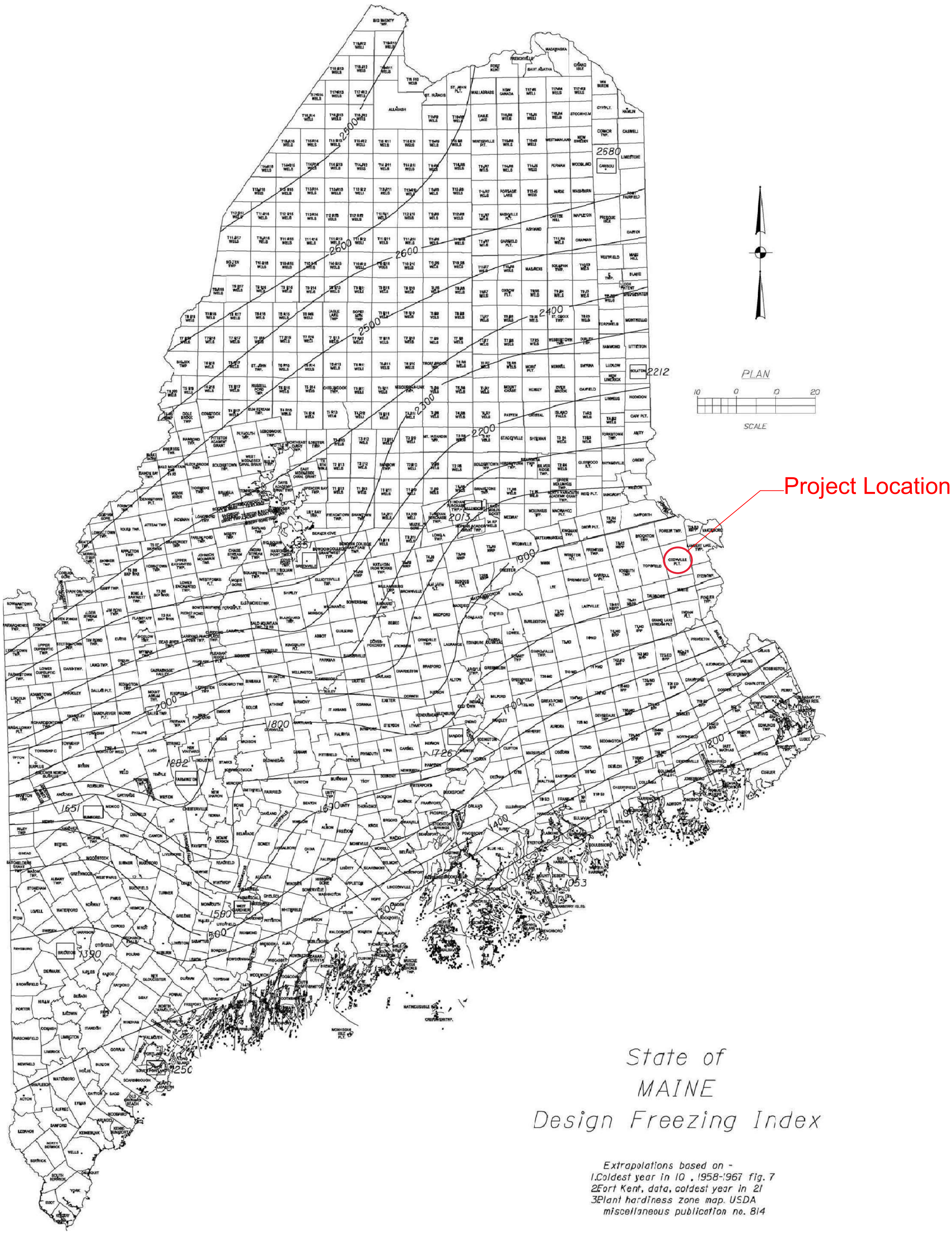


Figure 5-1 Maine Design Freezing Index Map

5.2 General

MaineDOT Bridge Design Guide

5.2.1 Frost

Any foundation placed on seasonally frozen soils must be embedded below the depth of frost penetration to provide adequate frost protection and to minimize the potential for freeze/thaw movements. Fine-grained soils with low cohesion tend to be most frost susceptible. Soils containing a high percentage of particles smaller than the No. 200 sieve also tend to promote frost penetration.

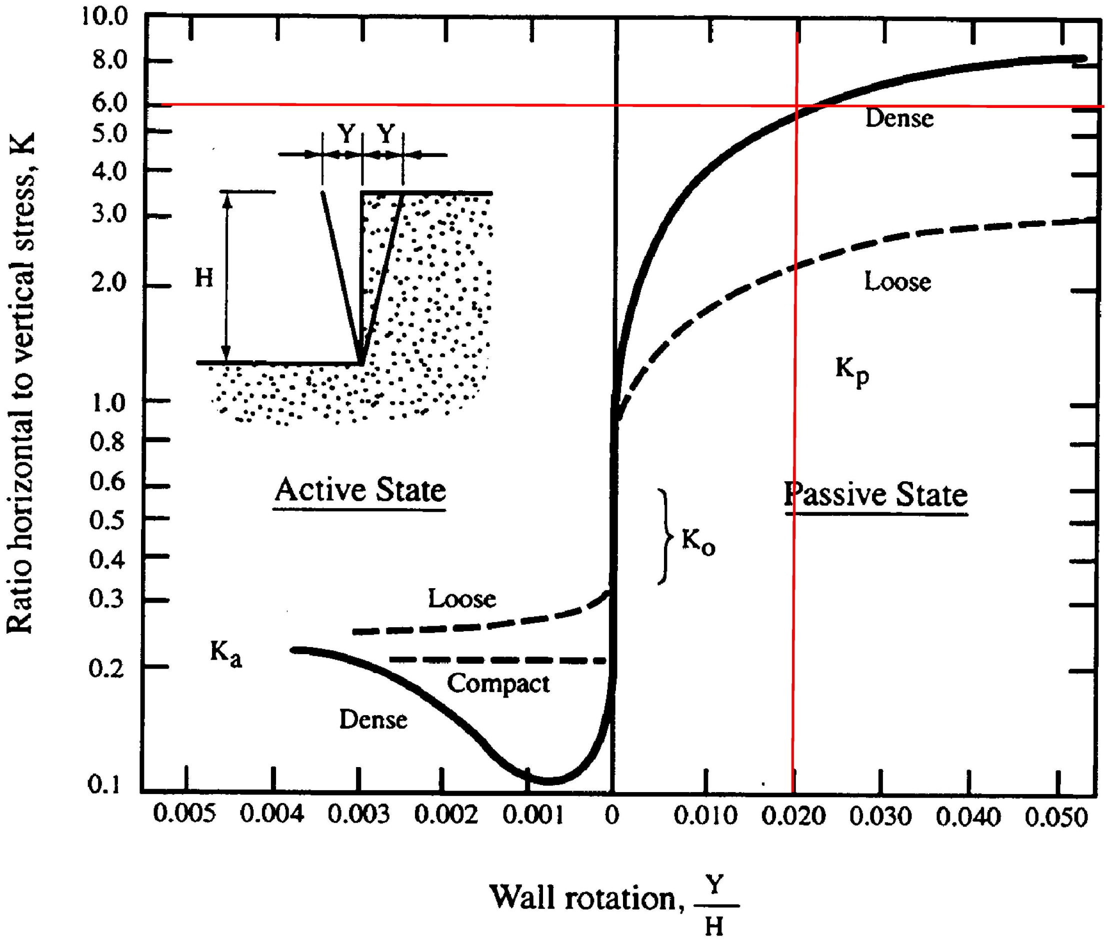
In order to estimate the depth of frost penetration at a site, Table 5-1 has been developed using the Modified Berggren equation and Figure 5-1 Maine Design Freezing Index Map. The use of Table 5-1 assumes site specific, uniform soil conditions where the Geotechnical Designer has evaluated subsurface conditions. Coarse-grained soils are defined as soils with sand as the major constituent. Fine-grained soils are those having silt and/or clay as the major constituent. If the make-up of the soil is not easily discerned, consult the Geotechnical Designer for assistance. In the event that specific site soil conditions vary, the depth of frost penetration should be calculated by the Geotechnical Designer.

Table 5-1 Depth of Frost Penetration

Design Freezing Index	Frost Penetration (in)					
	Coarse Grained			Fine Grained		
	w=10%	w=20%	w=30%	w=10%	w=20%	w=30%
1000	66.3	55.0	47.5	47.1	40.7	36.9
1100	69.8	57.8	49.8	49.6	42.7	38.7
1200	73.1	60.4	52.0	51.9	44.7	40.5
1300	76.3	63.0	54.3	54.2	46.6	42.2
1400	79.2	65.5	56.4	56.3	48.5	43.9
1500	82.1	67.9	58.4	58.3	50.2	45.4
1600	84.8	70.2	60.3	60.2	51.9	46.9
1700	87.5	72.4	62.2	62.2	53.5	48.4
1800	90.1	74.5	64.0	64.0	55.1	49.8
1900	92.6	76.6	65.7	65.8	56.7	51.1
2000	95.1	78.7	67.5	67.6	58.2	52.5
2100	97.6	80.7	69.2	69.3	59.7	53.8
2200	100.0	82.6	70.8	71.0	61.1	55.1
2300	102.3	84.5	72.4	72.7	62.5	56.4
2400	104.6	86.4	74.0	74.3	63.9	57.6
2500	106.9	88.2	75.6	75.9	65.2	58.8
2600	109.1	89.9	77.1	77.5	66.5	60.0

Appendix E

References



Magnitude of Wall Rotation to Reach Failure

Soil type and condition	Rotation, Y/H	
	Active	Passive
Dense cohesionless	0.001	0.02
Loose cohesionless	0.004	0.06
Stiff cohesive	0.010	0.02
Soft cohesive	0.020	0.04

Figure 10-4. Effect of wall movement on wall pressures (after Canadian Geotechnical Society, 1992).

allowed on the bridge before pouring the abutment diaphragm. In such cases, the Load Factors for Construction Loads shall be taken as per Article 3.4.2 of the *AASHTO LRFD Bridge Design Specifications*.

3.10.7 Superstructure Design Methodology

The connection between the beams and the abutment shall be assumed to be simply supported for superstructure design and analysis. It is recognized that, in some cases, it may be desirable to take advantage of the frame action in the superstructure design by assuming some degree of fixity. This, however, requires careful engineering judgment. Due to the uncertainty in the degree of fixity, frame action shall not be used to reduce design moments in the beams.

3.10.8 Pile Cap and Abutment Diaphragm Design

The superstructure is assumed to transfer moment, and vertical and horizontal forces due to all applicable loads, at the time when the rigid connection with the abutment is achieved. The effects of skew, curvature, thermal expansion of the superstructure, reveal, and grade are considered.

The design provisions below are conservative because the pile cap and the abutment diaphragm are very rigid members, therefore all loads shall be uniformly distributed across the abutment.

For the integral abutments constructed in two stages as specified above, the abutment shall be designed for the following two cases:

1. The pile cap is designed to resist all vertical loads including live load. It is assumed to act as a continuous beam supported by piles. The analysis can be simplified by assuming the pile cap acting as a simple span between piles and then taking 80% of simple span moments to account for continuity. Shears may be taken equal to simple span shears.

2. The entire abutment wall (the combined height of the pile cap and the abutment diaphragm) is designed to resist the earth pressure due to the backfill material, assuming the wall to act as a horizontal continuous beam supported on the girders, i.e., with spans equal to the girder spacing along the skew (if any).

The abutments should be kept as short as possible to reduce the magnitude of soil pressure developed. A minimum of 3’-0” for inspection access shall be provided. A minimum fill cover over the bottom of the abutment of 3’-0” is desirable. It is recommended to have abutments of equal height due to the fact that a difference in abutment heights causes more movements to take place at the shorter abutment. Abutments of unequal height shall be designed by balancing the earth pressure consistent with the magnitude of the displacement at each abutment.

The magnitude of lateral earth pressure developed by the backfill is dependent on the relative wall displacement, δ_T/H, and may be considered to develop between full passive and at-rest earth pressure. The backfill force shall be determined based on the movement-dependent coefficient of earth pressure (K). Results from full scale wall tests performed by UMASS[1] show reasonable agreement between the predicted average passive earth pressure response of MassDOT’s standard compacted gravel borrow and the curves of K versus δ_T/H for dense sand found in design manuals DM-7[2] and NCHRP[3]. For the design of integral abutments, the coefficient of horizontal earth pressure when using compacted gravel borrow backfill shall be estimated using the equation:

$$K = 0.43 + 5.7[1 - e^{-190(\delta_T/H)}]$$

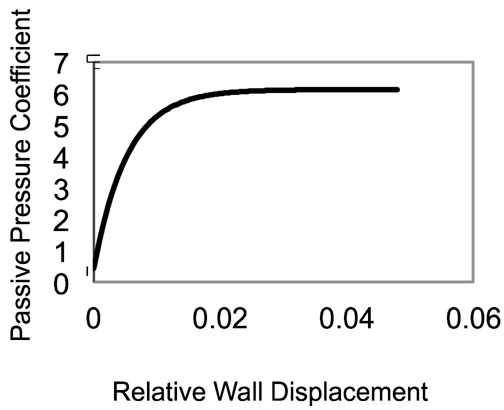


Figure 3.10.8-1: Plot of Passive Pressure Coefficient, K, vs. Relative Wall Displacement, δ_T/H.

The simplified approach may be used to calculate moments and shears in the abutment walls, assuming the abutment wall acting as a simple span between piles and then taking 80% of simple span moments to account for continuity. Shears may be taken equal to simple span shears. Due to the relatively large dimensions of the abutment walls, minimum reinforcement is usually sufficient to satisfy the strength requirements.

The longitudinal reinforcement of the pile cap shown in Chapter 12 of Part II of this Bridge Manual represents an upper–bound for the required reinforcement assuming the girders are located at the positions that produce maximum effects on the pile cap and assuming a conservative value of other dead loads on the abutment wall.

Stirrups intended to resist horizontal shear forces acting on the pile cap due to soil passive pressure shall be provided as shown in Part II of this Bridge Manual.

L-shaped connection reinforcing bars indicated in the standard drawings of Chapter 12 of Part II and Chapter 2 of Part III of this Bridge Manual shall be provided to transfer the maximum expected connection moment between the abutment and the superstructure. These bars shall be #6 @ 9” for girders up to 8 feet deep. For deeper girders they shall be designed. The vertical leg of the connection bars shall be placed as close as practical to the back face of the abutment. The horizontal leg shall be extended into the deck beyond the inside face of the abutment diaphragm at the elevation of the deck top longitudinal reinforcement for a length equal to 10% of the span plus the development length, for simple span bridges. For continuous span bridges the bars shall be extended to 10% of the end span plus the development length.

Refer to Chapter 12 of Part II and Chapter 2 of Part III of this Manual for more information on the integral abutment reinforcement.